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M.DCCC.XXX.

THE

EDINBURGH ENCYCLOPÆDIA.

CHEMISTRY,

History.

Is the science which treats of those events or changes in natural bodies, that are not accompanied by sensible motions. Its object is to ascertain the constituents of bodies, and the laws by which the simple atoms of matter unite together and form compounds.

Origin.

Neither the origin nor primitive meaning of the word *Chemistry*, in Greek χημια, or χημεια, is accurately known. That it was used by the Greeks, at least soon after the commencement of the Christian era, is certain; and many reasons coincide to render it probable that it was of Egyptian origin.

It is certain, that the χημια or *chemistry* of the ancients, was the name of an art of some kind or other. Suidas, a Greek writer of the ninth century, mentions this particularly in his Lexicon, under the word χημεια. He informs us, that it was an Egyptian art, practised at least as early as the third century: for Dioclesian, he tells us, ordered all the chemical books of the Egyptians to be sought out and burnt, because they had rebelled against him.

Original meaning.

A great many circumstances, which it would be tedious to adduce here, render it probable, that the word *chemistry*, among the Egyptians, was, at a very early period, nearly equivalent to our phrase *natural philosophy* in its most extensive sense, and comprehended all the knowledge of natural objects which they possessed. It is well known, that among the Egyptians all science was confined to the priests, who, considering it as a sacred deposit, took every precaution to conceal it from the people. It is possible, that this was the reason why natural philosophy got from them the name of *Chemistry*, which, in Plutarch's opinion at least, implied the *hidden* or *secret science*.

Of the progress which natural philosophy had made among the Egyptians, it is impossible for us at this distance of time to judge. The secrecy which they observed, precluded their improvements from being fully detailed by other nations; and all their genuine records and writings have been lost and destroyed in the shock of the numerous revolutions to which that hapless nation has been subjected. Some gleanings may indeed be gathered from the writings of Herodotus, Plato, Diodorus Siculus, Plutarch, and other Grecian philosophers, who were indebted for their information to the Egyptian priests, and from Eusebius, who has preserved some traces of their writings. From these gleanings, and from the lamp of philosophy which they kindled in Greece, it is evident that they had made some progress in the mathematical sciences; but it cannot be inferred, that they were acquainted with that branch of science which we at present call *chemistry*. They were, indeed, acquainted with various chemical facts; but these had neither been classified nor generalized.

New meaning.

In process of time, the word *chemistry*, as has been the case with many other terms, (the English word *physician*, for instance,) seems gradually to have acquired a more limited and precise signification; and instead of implying the whole of *natural philosophy*, as was originally the case, to have been confined to the *art of working metals*. This gradual change seems to have been, in a great measure, owing to the great importance attached by the ancients to the art of working metals. The founders and improvers of it were considered as the greatest benefactors of the human race; statues and temples were dedicated to their honour; and mankind, in the transports of their gratitude, raised them above the level of humanity, and enrolled them in the number of the gods.

How long the word *chemistry* retained this new signification, we do not know with accuracy. But in the time of Dioclesian, as Suidas informs us, it had acquired another and still more limited meaning, namely, the *art of making gold and silver*. The cause of this new limitation, and the origin of the opinion that gold can be made by art, are equally unknown. The art appears to have been cultivated with considerable eagerness by the Grecian ecclesiastics, to have passed from the Greeks to the Arabians, and by the Arabians to have been brought in-

The Alchymists.

to the west of Europe. Those who believed in it gradually assumed the form of a sect, under the name of *Alchymists*, a term which is supposed to be merely the word *chemist* with the Arabian article *al* prefixed. Thus the word *chemistry*, originally the same with natural philosophy, was at last, in consequence of a very whimsical revolution, applied solely to the *art of making gold*.

The alchymists laid it down as a first principle, that all the metals are composed of the same ingredients; or rather they affirmed, that the principles which compose gold exist in all the metals, contaminated indeed with various impurities, but capable, by a proper purification, of being brought to its perfect state. The great object, therefore, of their researches, was to find out the means of producing this purification, and consequently of converting the baser metals into gold. The substance which possesses this wonderful property they called *lapis philosophorum*, or the *philosophers' stone*. And many of them boasted, that they were in possession of this grand instrument.

Chemistry, as the term was used by the alchymists, was the *art of making the philosophers' stone*. They affirmed, that this art was above the reach of the human capacity; and that it was made known by God to those happy sages only whom he peculiarly favoured. The fortunate few who were acquainted with the philosophers' stone called themselves *adepti, adepts*, that is, persons who had got possession of the secret. This secret, they pretended, they were not at liberty to reveal, affirming that dire misfortune would fall upon that man's head who ventured to disclose it to any of the sons of men, without the clearest tokens of the divine authority.

The alchymists, in consequence of these notions, made it a rule to keep themselves as private as possible. They concealed, with the greatest care, their opinions, their knowledge, and their pursuits. And in their communications with each other, they adopted a mystical and metaphorical stile, and employed peculiar figures and signs, that their writings might be understood by the adepts only, and might be entirely unintelligible to common readers.

Notwithstanding all these obstacles, a great number of alchymistical books made their appearance during the dark ages; many of them under the real names of the authors, but a still greater number under feigned titles, or ascribed to the celebrated sages of antiquity. Though, during the whole of this period, the art of printing was unknown, and books consequently were multiplied with great labour and expence, this does not seem to have much lessened the number of alchymistical tracts. They must, therefore, have been bought up with eagerness, even by those who had no pretensions to the title of adepts; but who were buoyed up by the delusive hopes of becoming masters of the grand secret, and of suddenly rising by its assistance to affluence and distinction.

How far the alchymistical sect had extended among the ancients, or whether it had assumed the form of a sect, it is impossible to say. Traces of it appear among the Arabians, who turned their attention to literature soon after the conquest of the caliphs, and who communicated to our barbarous ancestors the sacred seeds of science. The principal chemical writers among the Arabians were Geber and Avicenna; and in their writings, such of them at least as we have reason to consider as authentic, there appears but little of that mysticism and enigma which afterwards assumed a systematic form.

The alchymists seem to have been established in the west of Europe at least as early as the 8th century. Between the 11th and 15th centuries, alchymy was in its most flourishing state. The writers who appeared during that period were sufficiently numerous, and very different from each other, both in their style and abilities. Some of their writings are totally unintelligible, and bear a stronger resemblance to the reveries of madmen, than to the sober investigations of philosophers. Others, if you make allowance for their metaphorical style, are written with comparative plainness, display considerable acuteness, and indicate a pretty extensive acquaintance with natural objects. They often reason with great accuracy, though generally from mistaken principles; and it is not unfrequently easy enough to see the accuracy of their experiment, and even to point out the particular circumstance which led to their wrong conclusions.

The principal alchymists who flourished in Europe during the dark ages, and whose names deserve to be recorded, either on account of their discoveries, or on account of the influence which their writings and example had in determining the public taste, were Albertus Magnus, Arnoldus de Villa Nova, Roger Bacon, Raymond Lully, and the two Isaacs of Holland.

Albertus Magnus.

Albertus Magnus was born in the year 1205, and died in 1280. He was a German, and, during the early part of his life, was so remarkable for his dulness, that he became the jest of his acquaintances. When about 17, he appeared at the university of Paris, where he studied with eclat, and where afterwards he obtained the title of *doctor*. He joined the order of Dominican Monks at Cologne, and was also bishop of Ratisbon. His works are very numerous; but those relating to chemistry are only three tracts. 1. A treatise entitled *De Alchymia*, in which he gives a very distinct account of all the chemical substances known in his time, and of the manner of obtaining them. He describes also, very concisely and clearly, the different instruments then employed by chemists, and the various operations which they had occasion to perform. This treatise, therefore, is of considerable value, because it exhibits with fidelity the state of chemistry in the 13th century. Towards the end, indeed, he falls into the common cant of the alchymists; but even then he uses but little of their ambiguous and metaphorical language. 2. His second treatise is on *Minerals*, and is equally plain and sensible. 3. If the third treatise, entitled *Lilium de Spinis Evalsum*, be genuine, it must have been written at a very different period of life; for it is infinitely inferior to the two others.

Thomas Aquinas.

Albertus, during one period of his life, taught publicly in the university of Paris, where he is said to have had for a pupil the celebrated Thomas

Aquinas, who afterwards wrote several treatises on alchymy, not inferior, in point of mysticism, to the other works of that renowned divine. There are, however, several words and phrases (*amalgam*, for instance) still retained in chemistry, which make their first appearance in his works. And his theories, which are ingenious enough, tend not a little to elucidate the data on which the alchymists went. We find, too, in him the commencement of that combination of astrology and alchymy, which makes so conspicuous a figure in the writings of his successors.

Roger Bacon.

At the same time with Albertus, lived Roger Bacon, by far the most illustrious, the best informed, and the most scientific of all the alchymists. He was born in 1224, in the county of Somerset in England; studied at Oxford, and afterwards at Paris. He became a cordelier friar, and, devoting himself to philosophical investigations, his discoveries, notwithstanding the pains which he took to conceal them, made such a noise, that he was accused of magic, and his brethren in consequence threw him into prison.

His writings display a degree of knowledge and extent of thought scarcely credible, considering the time when he wrote. In his small treatise, *De Mirabili Potestate Artis et Naturæ*, he begins by pointing out the absurdity of believing in magic, necromancy, charms, or any of those similar opinions which at that time were universally prevalent. He points out the various ways in which mankind are deceived by jugglers, ventriloquists, &c.; mentions the advantages which physicians may derive from acting on the imaginations of their patients, by means of charms, amulets, and infallible medicines; affirms that many of those things which are considered as supernatural, are merely so because mankind in general are unacquainted with natural philosophy. To illustrate this, he mentions a great number of natural phenomena which had been reckoned miraculous, and concludes with several secrets of his own, which he affirms to be still more extraordinary imitations of nature. These he delivers in the enigmatical stile of the times, induced, as he tells us, partly by the conduct of other philosophers, partly by the propriety of the thing, and partly by the danger of speaking too plainly. One of these secrets is a description of gunpowder, in language which cannot be mistaken. This was more than a century before Swartz, the German, who got the credit of the discovery, even existed.

Arnoldus de Villa Nova.

Arnoldus de Villa Nova lived at the same time with Roger Bacon. He was a physician, and seems to have been born at Villeneuve, a village in Provence, about the year 1240. He travelled through Spain, France, and Italy, and afterwards taught publicly in the university of Montpellier. His reputation as a physician was so great, that his attendance was requested in dangerous cases by different kings, and even by the Pope himself. He was skilled in all the sciences of his time, and was besides a proficient in Greek, Hebrew, and Arabic. When at Paris he studied astrology, and calculating the age of the world, found that it was to terminate in the year 1335. The theologians of Paris exclaimed against this and several of his other opinions, and condemned our astrologer as a heretic. This obliged him to leave France; but the Pope protected him. He died in 1313, on his way to visit Pope Clement V. who lay sick at Avignon. He has got the credit, (though, as far as appears, without deserving it,) of the discovery of spirit of wine and oil of turpentine. But he seems to have been one of the first that introduced these substances into pharmaceutical preparations. All his life long he was passionately devoted to alchymy. His writings on the subject are numerous. They all treat of the philosophers' stone, and are much more obscure than those of his predecessors; though it must be acknowledged that some important facts now and then occur in them. Perhaps the most curious of his tracts is his *Rosarium*, which is intended as a compend of all the alchymy of his time. It is divided into two parts: The first, which treats of the theory of the art, is plain enough; but the second, on the practice, which is subdivided into 32 chapters, and which professes to teach the method of making the philosophers' stone, is in several places unintelligible.

Raymond Lully.

Raymond Lully, who was born at Barcelona in 1235, was a disciple of Arnold, though they were both nearly of the same age, and died almost at the same time. The history of Raymond is very obscure. According to some, he was at first a profound logician, but, being disgusted with the vanity of disputing without end about trifles and absurdities, he turned the whole of his attention to alchymy. He afterwards travelled through France, Germany, and England; and, if some accounts are to be credited, he was at last stoned to death in Africa for preaching Christianity. His chemical writings are very numerous; but the whole of them are so obscure, and abound so much in ridiculous whims and absurdities, that they hardly deserve the labour of a perusal. He seems to have been the first who introduced those hieroglyphical pictures or symbols, which afterwards appeared in such profusion in the writings of the alchymists. He was, however, the discoverer, or at least the first describer, of some very important chemical agents.

J. I. Hollandus.

John Isaac Hollandus, and his countryman of the same name, were either two brothers, or a father and son. They were born in Stolk, a village in Holland, it is supposed in the 13th century. They wrote various treatises on chemistry, remarkable, considering the time when they lived, for clearness and precision. They describe all their processes with accuracy, and even give figures of the instruments which they employed. This renders their works very intelligible; and they deserve attention, because they exhibit the clearest proofs that many of the processes supposed of much more modern date were well known to them.

These are the principal alchymistical writers. It would be tedious and useless to enlarge the catalogue, as the greater number of their writings are remarkable for nothing but obscurity and absurdity. They all boast that they are in possession of the philosophers' stone; they all profess to communicate the method of making it; but their language is enigmatical, that only the wise may receive instruction, and that they may assist those adepts alone who are favoured with illumination from heaven. Their writings, in those benighted ages of ignorance, gained implicit credit, and the covetous were filled with ridiculous desires to enrich themselves by means of their discoveries. This laid the unwary open to the tricks of a set of impostors, who went about the world pretending that they were in possession of the secret of the philosophers' stone, and offering to communicate it to others for a suitable reward. Thus they contrived to get possession of a sum of money, and afterwards they either made off with their booty, or tired out the patience of their pupils by intolerably tedious, painful, expensive, and ruinous processes. It was against these men that Erasmus directed his well known satire, entitled *The Alchymist*. The tricks of these impostors gradually exasperated mankind against the whole fraternity of the alchymists. Books appeared against them in all quarters, which the art of printing, just invented, enabled the authors to spread with facility: The wits of the age directed against them the shafts of their ridicule; men of science endeavoured to point out the impossibility, or at least the infinite difficulty, of the art; men of learning rendered it probable that it never had been understood; and men in authority endeavoured, by laws and by punishments, to save their subjects from the talons of impostors.

Basil Valentine.

The chemists, of whom we have hitherto spoken, confined their researches chiefly to the metals and to the method of making gold; throwing out, however, occasional hints of the importance of their art in medicine. But the first man who formally applied chemistry to medicine was Basil Valentine. He is said to have been born in 1394, and to have been a Benedictine monk at Erford, in Germany. He wrote various treatises on chemistry, in all of which he applies it to medicine. The most important and famous of them, is his *Currus triumphalis Antimonii*, in which he celebrates the virtues of antimonial medicines, of which he had been the original discoverer. He first taught the doctrine, that all substances are composed of *salt*, *sulphur*, and *mercury*, which makes so prominent a figure in the writings of some of his successors.

Chemists had for ages hinted at the importance of discovering a universal remedy, which should be capable of curing, and even of preventing, all diseases; and several of them had asserted, that this remedy was to be found in the philosophers' stone; which not only converted base metals into gold, but possessed also the most sovereign virtue, and was capable of curing all diseases in an instant, and even of prolonging life to an indefinite length, and of conferring upon the adepts the gift of immortality upon this earth. This notion gradually gained ground, and the word *chemistry*, in consequence, at length acquired a more extensive signification, and implied not only the *art of making gold*, but the *art* also of *preparing the universal medicine*. Just about the time that the first of these branches was sinking into discredit, the second, and with it the study of chemistry, acquired an unparalleled degree of celebrity, and attracted the attention of all Europe. This was owing to the appearance of that very extraordinary man Theophrastus Paracelsus.

Paracelsus.

He was born in 1493, near Zurich, in Switzerland. His father, who was a medical practitioner, instructed him in physic and surgery. Conceiving a passion for alchymy, he was put under the care of Trithemius, abbot of Spanheim, and afterwards of Sigismund Fuggerus, from whom he acquired the practical part of the art. Afterwards he visited all the universities of Germany, Italy, France, and Spain, and travelled through almost every country in Europe; consulting indifferently, physicians, barbers, old women, conjurers, and chemists. At the age of 20 he was taken prisoner by the Tartars, and carried before the Czar of Russia, whose son he accompanied in an embassy to Constantinople; where, as he tells us, he was first let into the secret of the philosophers' stone. He now applied himself to the practice of medicine with so much success, that he acquired, in consequence, a very great reputation. The venereal disease had, a little before, made its appearance in Italy, and was now carrying its ravages over Europe, and baffling the feeble attempts of the regular physicians of the times. Paracelsus, previously instructed by Carpus of Boulognia in the method of treating it by means of mercury, cured that formidable disease wherever it presented itself, with comparative ease, and with the most unbounded applause. Opium, too, which he employed with freedom, enabled him to cure, or at least to palliate, many painful disorders.

In the 34th year of his age, when his reputation was at its height, he was appointed by the magistrates of Basle to deliver lectures in their town, and thus was the first public professor of chemistry in Europe; for before that time, the science was not taught in any university. In two years he quarrelled with the magistrates about a medical fee, and left the city. He rambled up and down the country, his disciples gradually forsook him, he sunk into the deepest dissipation, being scarcely ever sober, and never changing his clothes, not even during the night. At last, in the month of September 1541, he died at Salzburg, after a few days illness, in the 47th year of his age. Though he boasted all his life long that he was in possession of the universal medicine, which he called *elixir proprietatis*, by which he could not only cure all disorders, but prolong his own life to an indefinite length, and he actually talked of living to the age of Methuselah.

It is not necessary to draw any character of this extraordinary man. That he was an impostor, and boasted of secrets which he did not know, cannot be denied; that he stole many opinions, and even facts, from others, is equally true; his arrogance was insupportable, his bombast ridiculous, and his whole life a continued tissue of blunders and vice. At the same time, it must be acknowledged that his talents were great, and that his labours were not entirely useless. He contributed not a little to dethrone Galen and Avicenna, who at that time ruled over medicine with absolute power, and to reinstate Hippocrates on that chair from which he ought never to have risen. He certainly gave chemistry an eclat which it did not before possess; and this must have induced many of those laborious men who succeeded him to turn their attention to the science. Nor ought we to forget, that, by carrying his speculations concerning the philosophers' stone and the universal medicine to the greatest height of absurdity, and by exemplifying their emptiness and uselessness in his own person, he undoubtedly contributed more than any man to their disgrace and subsequent banishment from the science. Just as Mr Hume, by carrying the ideal system to the utmost pitch of extravagance, may be in some measure considered as the occasion of that general reform in metaphysics which has since taken place.

Van Helmont.

In 1577, or just 36 years after the death of Paracelsus, his great admirer and disciple Van Helmont was born of a noble family at Brussels. He studied medicine contrary to the inclination of his relations, was early distinguished for his extensive reading and great knowledge, and was created doctor of medicine at the age of 22, having previously read public lectures on surgery at Lovain. Soon after, happening to get a slight itch, and perceiving that the regular treatment had no effect upon it, but that sulphur speedily removed it, he became in consequence disgusted with medicine, renounced the study, divided his fortune among his relations, and left his country with an intention never more to return. He spent ten years in travelling; and at last, having acquired a knowledge of chemistry, he became violently attached to it, and resolved to devote to it the remainder of his life. In 1609, he married and returned to Wilvoord, where he employed himself in making chemical experiments, and in applying that science to medicine. His publications soon gave him celebrity, and he was more than once invited to the court of Vienna. He died in 1644, at the age of 67. Like his predecessor Paracelsus, he boasted that he was in possession of the universal remedy, to which he gave the name of *alkahest*. His chemical discoveries were numerous, and justly entitle him to distinction.

Van Helmont may be considered as the last of the alchymists. His death completed the disgrace of the universal medicine, which afterwards, like the philosophers' stone, was considered by all rational chemists as a palpable absurdity. His contemporaries, and those who immediately succeeded him, if we except Crollius and a few other blind admirers of Paracelsus, attended solely to the improvement of chemistry, and the refutation of the absurd tenets of the alchymists. The chief of them were Agricola, Beguin, Glaser, Erkern, Glauber, Kunkel, Boyle, &c.

The foundations of the alchymistical system being thus shaken, the facts which had been collected tumbled into a heap of rubbish, and chemistry was left without any fixed principles, to wander about in the dark, destitute of an object. At last, there arose a man thoroughly acquainted with the whole of these facts, capable of arranging them, and of perceiving the important purposes to which they might be applied, and able to point out the proper objects to which the researches of chemists ought to be directed.

Beccher.

This man was Beccher. He accomplished the arduous task in his work entitled *Physica Subterranea*, published at Frankfort in the year 1669. The publication of this book forms a very important era in the history of chemistry. It then escaped for ever from the trammels of alchymy, and became the science which we find it at present.

Thus it appears, that the word *chemistry* has had at different times no less than five meanings. It first signified *natural philosophy;* afterwards it was restricted to the *art of working metals;* at a later period it meant the *art of making gold;* at a still later period, the discovery of a *universal medicine* was also included under it; and, last of all, in 1669, it became the *science* which *investigates the insensible motions of bodies*. Thus, after a variety of transformations, it stopped at last, and now comprehends under it precisely one-half of its original signification. At first it was the name of the whole of natural science, whereas now it is only the name of one of the two branches into which science is divided.

John Joachim Beccher, to whom the honour of laying the foundation of the science of chemistry belongs, was born at Spires in 1625, and seems to have been of Jewish extraction. He was first a professor of medicine, then physician to the Elector of Mentz, and afterwards to the Elector of Bavaria. Towards the end of his life, he went to England, and died in London in 1682, as is suspected, in great poverty. His writings testify with what success he applied himself to the study of chemistry.

Stahl.

Ernest Stahl, his disciple, and the commentator of the *Physica Subterranea*, gave the science a degree of order and extension which raised it in some respects to a level with mechanical philosophy, and secured to himself the highest and most exalted reputation. This philosopher, a German, first physician to the King of Prussia, professor of medicine and of chemistry, who was born in the year 1660, seems to have been actuated from his very infancy by a violent passion for chemistry. At the age of fifteen he could repeat, by heart, the whole of the *Chemia Philosophica* of Barnerus, at that time the most popular book on the subject. He attached himself particularly to the writings of Beccher, whom he resembled in activity and brilliancy of imagination, and far surpassed in precision and judgment. Beccher's theory, in his hands, was new modelled and simplified. He explained the nature of combustion, and reduced the phenomena of chemistry under a certain number of general heads. His system forms as complete a whole, and has as imposing an aspect, as any which has hitherto been promulgated. It was the result of very cautious researches, and was elucidated and confirmed by satisfactory experiment. No wonder, then, that its author attracted general admiration, and that he was dignified with the title of the *sublime* Stahl. His theory consisted in supposing, that a certain substance, called *phlogiston*, forms a part of all combustible bodies; that its separation constitutes *fire*, while its various combinations produce most of the other phenomena of chemistry. It was first developed soon after the commencement of the 18th century; and Stahl's *Fundamenta Chemiæ* were first published in 1723. For a period of almost fifty years after the appearance of that book, the sole object of chemists was to confirm and extend the theory of the author. And it applied so happily to their different discoveries,—enabled them in many cases to foretel the event,—and assisted them so much to penetrate into the still unexplored recesses of nature, that we have no reason to be surprised at the admiration which it excited,—at the attachment which chemists displayed for it,—and the violence with which they supported it.

Boerhaave.

A system of chemistry, published in 1732, contributed, perhaps, as much as the theory of Stahl, though in a very different way, to the improvement and subsequent popularity of chemistry. This system was written by Boerhaave, one of the most accomplished philosophers, and perhaps the most celebrated physician that ever flourished in modern Europe. A surreptitious copy of his chemical lectures having been printed by some of his pupils, he was under the necessity, in 1732, of revising and publishing his system of chemistry: a system which contained a much fuller collection of chemical experiments, and more exact directions for repeating them, than any previously offered to the world. The bounds of the science were enlarged by this acute philosopher, who had stored his mind with the principles of mechanical philosophy. His account of fire, of thermometers, and other similar chemical instruments, was excellent, considering the period in which he wrote.

Margraaff.

Rouelle and Macquer.

The taste for chemistry which these celebrated men had inspired, together with the numerous academies and societies of different kinds all over Europe, who dedicated a portion of their time to chemical researches, occasioned numerous publications on that subject, and several discoveries of importance were the result. The science became more and more respectable, and the Stahlian theory was more completely developed, especially in Germany and in France, where several chemists of eminence successively cultivated the science. Among the German chemists, none holds a higher rank than Margraaff, a member of the Berlin Academy, to whom we are indebted for some very important discoveries. He first had the courage to call in question the authority of Stahl; and his experiments on phosphorus destroyed one of the strong holds upon which the Stahlian theory depended. Rouelle and Macquer, two Frenchmen, and associated teachers, were scarcely less celebrated; the first as a skilful practical chemist, the second as an eloquent lecturer. The first may be considered as the founder of the chemistry of animal bodies as it exists at present. When he published his analysis of urine and blood, he had scarcely any model. To Macquer, born at Paris in 1718, we are indebted for an elementary treatise on chemistry, written with such simplicity and perspicuity, that it stamped the form of subsequent works, and was even used in the different universities of Europe. We are indebted to Macquer also for a dictionary of chemistry, first published in 1766, which contributed in no common degree to the improvement of the science. In this work, the different chemical substances and instruments were described,—the theories were explained and examined,—the improvements still wanted were pointed out,—the errors and imperfections were stated with a clearness and warmth which never fail to interest the reader. This dictionary was translated into Italian, German, and English; and the translators, who were all well acquainted with the subject, rendered it still more complete by their valuable notes.

Bergman.

Chemistry was still far from being on [illegible] footing with mechanical philosophy. The reasoning employed was often loose and unsatisfactory, and frequently amounted to nothing more than far-fetched and ill-conducted analogies. The correction of these faults required all the influence of a man who had been accustomed to the rigid accuracy of mathematical demonstration,—whose profound mind had embraced every part of human knowledge,—whose sound judgment could not be biassed by prejudice,—whose industry was not to be overcome by fatigue, or want of health,—whose candour and love of truth were not to be shaken,—and who generously sacrificed himself to the improvement of the sciences. Nor need we name this philosopher. Every one who is not a total stranger to chemistry must have heard of Bergman, whose very name is a sufficient panegyric. This illustrious Swede was born in 1735, at Catherinberg, in West Gothland. His father was receiver of the revenues in that province, a post at that time neither very lucrative nor respectable, which induced him to urge his son to assume the profession of law or divinity. Young Bergman accordingly went to Upsal with that intention, and commenced his studies under the inspection of a friend. But he very soon testified a dislike to both the professions for which he was intended, while he manifested a violent passion for mathematics and philosophy. His friend remonstrated with some severity, and pointed out the imprudence of his choice. Bergman listened in silence, but still persevered in his favourite pursuits. His friend deprived him of his books, restricted his studies, and left him only to choose between law and divinity. This restraint almost proved fatal: Bergman's health declined; it was found necessary for him to leave the university, and return home. His relations, finding it in vain to struggle with his inclinations, at last indulged them, and left him at liberty to pursue those studies of which he was so distractedly fond.

At that time Linnæus, after having surmounted obstacles sufficient to have crushed a man of ordinary energy, was in the height of his glory, and was revered every where as the patriarch of natural history. He had infused the enthusiasm which actuated his own breast into the minds of his pupils, and at Upsal every student was a natural historian. Bergman, in particular, attached himself to Linnæus, and bestowed much pains on botany and entomology. This last branch of natural history is deeply indebted to him. He first displayed in it those powers of arrangement which constitute the charm of his works, and that penetration which produced afterwards such important fruits. On his return to the university, he imparted his discoveries to Linnæus, who sent them with a very flattering panegyric to the Academy of Stockholm,—"*Vidi et obstupui!*"

In the year 1761, Bergman was appointed teacher of mathematics and natural philosophy at Upsal. He was in this situation in 1767, when Wallerius, at that time professor of chemistry at Upsal, resigned his chair. Bergman offered himself as a candidate for the vacant professorship. But Wallerius had other plans. There was a relation of his own whom he wished to succeed him, and the professors at Upsal had so much influence that few doubted but he would accomplish his plan. Bergman, to shew himself qualified for the place to which he aspired, published two dissertations on alum, which were attacked by Wallerius in a style of acrimony altogether unworthy of his reputation. Gustavus IV. late king of Sweden, was at that time Prince Royal, and chancellor of the university. The character and abilities of this extraordinary man, and the zeal with which he sometimes supported men of science, are well known. Fortunately for chemistry, and for the reputation of Sweden, Gustavus took the part of Bergman, on the recommendation, it is said, of Von Swab, who pledged himself to be answerable for his qualifications; and he was so keen on the subject, that he supported his cause in person before the senate. Wallerius and his party were of course baffled, and Bergman got the chair. He filled it with the greatest glory for seventeen years; and, during that period, his numerous publications entirely altered the appearance of chemistry. He introduced an order, a perspicuity, an exactness, which were unknown before, and which were certainly one of the great causes of the subsequent rapid progress of the science. Their influence was universally felt; and, as long as Bergman lived, he stood unrivalled on the continent at the head of the science.

But it was not his publications alone which constituted his merit. His lectures were no less valuable; and many of the pupils whom he educated, contributed, in no small degree, to spread his reputation. Gahn, Hielm, Gadolin, the Elhuyarts, and many others who afterwards acquired celebrity, were educated by him. His first care, after obtaining the chair, was to collect all the different chemical substances, and their products, and to form them into a cabinet. Another cabinet contained the minerals of Sweden, arranged according to the places from which they were obtained; and a third consisted of models of the different instruments employed in chemistry and in chemical manufactures. These were designed for the instruction of his pupils, whom he encouraged and inspired with that confidence and enthusiasm which is necessary for appearing with respectability in the republic of letters. One day he was told by one of his pupils, of a young man who resided in the house of an apothecary at Upsal, and who was reproached for neglecting his duties, that he might employ the whole of his time in the study of chemistry. Bergman's curiosity was excited. He paid the young man a visit, and was astonished at the knowledge which he displayed, and the profound researches which he had undertaken, notwithstanding the poverty under which he laboured, and the restraint under which his situation placed him. He encouraged his ardour, and made him his favourite pupil and friend. This young man was Scheele, one of the most extraordinary chemists that ever existed.

Scheele.

He was born in 1742, at Stralsund, the capital of Swedish Pomerania, where his father was a tradesman. Young Scheele, at a very early period of his life, shewed a strong inclination to learn pharmacy; and was accordingly bound apprentice to Mr Bauch, an apothecary at Gottenburg, with whom he lived eight years. Here he first found the impulse of that genius which afterwards made him so conspicuous. He durst not, indeed, devote himself openly to chemical experiments, but he contrived to make himself master of the science, by devoting those hours to study which were assigned him for sleep. According to the testimony of Mr Grunberg, his fellow apprentice, he was of a very reserved and serious disposition, but uncommonly diligent. He attended very minutely to all the processes,—reflected on them while alone, especially during the night-time,—and read every thing relating to the subject in the writings of Neuman, Lemery, Kunkel, and Stahl. Kunkel's *Laboratory* was his favourite book. He used secretly, during the night-time, to repeat experiments out of it. On one of these occasions, as he was employed in making pyrophorus, another apprentice, without his knowledge, put some fulminating powder into the mixture. The consequence was a loud explosion: the whole family was thrown into confusion, and our young chemist was severely chastised.

From Gottenburg, Scheele went to Malmo, and two years after to Stockholm. In 1773 he went to Upsal, and resided for some time in the house of Mr Loock. Here Bergman first found him,—saw his merit, and encouraged it,—adopted his opinions,—defended him with zeal, and took upon himself the charge of publishing his treatises. He gave him free access to his laboratory, and procured him a salary from the Swedish Academy. Encouraged by this magnanimous conduct, the genius of Scheele, though unassisted by education or by wealth, burst forth with astonishing lustre; and, at an age when most philosophers are only rising into notice, he had completed a career of discoveries which have no parallel in the annals of chemistry. His treatises are perfect models of chemical research, and display an ingenuity, knowledge, and address, which is altogether astonishing. Nothing was capable of baffling his patient industry, or of escaping his penetrating eye.

Scheele and Bergman cannot well be compared together. Their zeal, indeed, for the science, their candour, their love of truth, and their industry, were equal; but Bergman was distinguished by the extent of his views, and by the plans which he formed for the improvement of the science; Scheele, by the skill with which he conducted particular analyses, and the acuteness with which he distinguished substances by their properties. Bergman's views were general; Scheele's were particular. Bergman was the man for drawing the outline; but Scheele understood best how to fill it up. On one occasion, indeed, (we allude to his treatise on *fire*,) he attempted a general subject, but his success was not great. However, the acuteness with which he treated it must be admired; and the vast number of important facts which he brought forward to support his opinion, are truly astonishing, and perhaps could not have been brought together by any other man than Scheele.

Chemistry was deprived of these two illustrious philosophers, Bergman and Scheele, almost at the same time. Bergman died in 1784, at the baths of Medwi, in the 49th year of his age, crowned with glory, after a life spent in the most laborious industry. Scheele was snatched away in 1786, in the 44th year of his age. For about six months previous to his death, he had been severely afflicted with the gout. When he began to perceive that his end was approaching, he was induced, from a principle of gratitude, to marry the widow of his predecessor. The ceremony was performed on the 19th of May, while Scheele lay on his death-bed. On the 21st, he left her by his will the whole of his property; and the same day on which he had so tenderly provided for her, he died. "Thus," says Dr Crell, "in less than two years, the world lost Bergman and Scheele, two men of whom Sweden, rich as she is in great and learned men, has the strongest reason to be proud; two chemists who were equally beloved and lamented by their contemporaries, and whose names will be remembered by the remotest posterity with gratitude and reverence."

Black.

Cavendish.

Priestley.

While these philosophers were employed in cultivating chemistry in Sweden, discoveries were made in Scotland which changed the apparatus and the mode of reasoning, reduced under the dominion of chemistry a number of invisible substances which had been considered formerly as too subtile for exertion, and thus occasioned a complete revolution in the science. Dr Joseph Black, from whom these discoveries originated, was born in Bourdeaux, in 1728. His father was a native of Belfast, but of a Scotch family residing in Aberdeenshire. Dr Black was educated in Belfast, and completed his education at the universities of Glasgow and Edinburgh. He discovered, after an ingenious investigation, that limestone, and the mild alkalies, are compounds of lime and pure alkalies, with an aërial fluid, to which he gave the name of *fixed air*. This discovery led to the origin of pneumatic chemistry. Mr Cavendish soon after investigated the properties of fixed air and hydrogen gas. About the year 1770, the subject was taken up by Dr Priestley, who discovered a great variety of aërial fluids, and acquired a most splendid reputation. No man, not even excepting Scheele, ever began the cultivation of chemistry under greater disadvantages than Dr Priestley, and yet few have made more numerous or more important discoveries. He was an obscure dissenting clergyman, extremely unpopular in consequence of his opinions, which involved him in almost perpetual controversy; his income was exceedingly small, yet he was loaded with a family, and obliged to spend most of the day in teaching to be able to support them. He was totally ignorant of chemistry, unprovided with any apparatus, and not in possession of the means of supplying one. These circumstances, which at first sight seemed to preclude the possibility of his entering upon the chemical career, probably when coupled with his great abilities and activity, contributed essentially to his ultimate success.

Lavoisier.

The splendid discoveries of the British chemists drew the attention of Lavoisier to the subject as early as the year 1770. He repeated and verified all their experiments of importance, together with those of the German chemists. He was early satisfied of the imperfections of the Stahlian theory, with which the new discoveries in pneumatic chemistry could not be reconciled; and after a most elaborate and ingenious investigation, persevered in for a series of years, with the utmost application, he succeeded in establishing a theory nearly the reverse of that of Stahl. For several years after he had satisfied himself of the truth of his opinions, he was not able to produce a single convert either in France or in any other country. At last, Mr Cavendish, by discovering the composition of water and of nitric acid, removed the grand objections to his opinions, and enabled him to explain his new doctrine in a satisfactory manner. Upon this Mr Berthollet declared himself a convert in 1785. His example was followed by Fourcroy; and in 1787, Morveau, during a visit to Paris, was convinced of his former mistakes, and induced to embrace the same opinions. The example of these eminent men was followed by that of all the young chemists in France. Mr Kirwan, who had acquired a great reputation by his chemical writings, had published a defence of the doctrine of phlogiston. This essay Mr Lavoisier got translated into French, and it was published, with a refutation, by some eminent chemist, at the end of each section. The refutation convinced Mr Kirwan, and induced him to embrace the Lavoisierian theory. His example was followed by Dr Black, and by almost all the eminent British chemists. Indeed, Dr Priestley was almost the only one who did not renounce the phlogistic theory.

Lavoisier and his associates, to make their victory still more certain and complete, invented a new chemical nomenclature, which they proposed, in 1787, as a substitute for the old. This nomenclature they adopted in all their writings. A violent controversy was the result, which terminated in the complete triumph of the French nomenclature in every country in Europe.

Davy.

Such is a concise view of the progress of chemistry down to our own time. Within these few years, very splendid additions have been made to the science, especially by the sagacity of Mr Davy. And at present, in consequence of the recent and unexpected galvanic discoveries, the Lavoisierian theory stands a considerable chance of being new modelled, if not in a great measure overthrown. Several important and necessary modifications have already taken place, and others not less important will probably follow.

We shall endeavour in this article to give a concise but comprehensive view of the present state of the science. From the uncertainty to which chemical theory is liable, and the improbability of ever being able to reach absolute certainty, though every new modification and improvement is probably an approximation, we cannot avoid falling into error when we attempt to theorise. To this we are particularly liable in one very important branch of the science, that namely which treats of *heat*, which is still very vague, even in its best established points. But we shall endeavour to avoid error as far as is in our power, by adhering closely to accurate experimental details, and by pointing out, as clearly as we can, what is certain, from what is still doubtful or hypothetic.

We shall divide this article into three Parts. In the first, we shall treat of the elements of the science. In the second, we shall take a chemical view of nature. In the third, we shall give a short sketch of the most important *chemical apparatus*.

PART I.

ELEMENTS OF CHEMISTRY.

Elements of Chemistry. Object.

As the object of chemistry is to ascertain the constituents of bodies, the way in which these constituents combine, and the nature of the combinations which they form, the science naturally divides itself into three parts: 1. A description of the component parts of bodies, or of *simple substances*, as they are called. 2. An account of the *compound* bodies formed by the union of the simple substances. 3. An account of the nature of the power which induces the particles of bodies to unite. This power is usually called *affinity*. These three particulars will form the subject of the three following Books.

BOOK I.

OF SIMPLE SUBSTANCES.

Simple substances.

We are probably ignorant at present of bodies, strictly speaking, elementary or simple. All that is understood in chemistry by a *simple substance*, is a substance not yet decomposed, and which we cannot shew to be a compound. Those of that kind at present known are about forty-eight. They may be divided into two classes; those which can be confined in vessels, and of course exhibited in a separate state; and those which cannot be confined in any vessels that we possess, and the existence of which is only inferred from certain phenomena exhibited by the first class of bodies in certain circumstances. The first class of bodies may be called *confinable*, the second *unconfinable*.

DIVISION I.

Of Confinable Bodies.

Confinable bodies.

The confinable bodies may be arranged under the four following heads:

1. Simple supporters of combustion.
2. Simple combustibles.
3. Simple incombustibles.
4. Metals.

These classes shall be treated of in order in the four following Chapters.

Chap. I.

Of Simple Supporters of Combustion.

Simple supporters of combustion.

The term, *supporter of combustion*, is applied to those substances which must be present before combustible substances will burn. Thus *air* is a supporter of combustion, because a candle will not burn unless it be supplied with air. All supporters, not yet decompounded, are called *simple*.

Elements of Chemistry.

We are at present acquainted with two simple supporters of combustion, namely, *oxygen* and *chlorine*.

Sect. I. *Of Oxygen.*

Oxygen.

This substance is an *air*, or, as chemists use to call aërial bodies, a *gas*.* It was discovered by Dr Priestley, on the 1st of August 1774. It may be obtained by heating *black oxide of manganese* in an iron bottle fitted with a long iron tube. The extremity of the tube is plunged into a trough of water, having a shelf a little below the surface, on which stands an inverted glass cylinder full of water. The open mouth of this cylinder is brought over the extremity of the iron tube. As soon as the manganese is red hot, air issues from the extremity of the tube, and gradually fills the glass vessel, displacing the water. In this way any quantity of oxygen gas may be procured. Red lead, or red precipitate, may be substituted for the manganese, but they do not yield so much oxygen. The salt called hyperoxymuriate of potash may also be used, and it yields a very great proportion of pure oxygen. Oxygen gas may also be obtained, by putting the manganese in powder into a glass retort, and pouring on it as much *sulphuric acid* as will make it into a thin paste. The heat of a lamp being applied to the retort while its beak is plunged into the water trough, the gas is disengaged in considerable quantity.

How procured.

This gas was called by its discoverer *dephlogisticated air*; Scheele, who likewise discovered it, called it *empyrial air*; Condorcet gave it the name of *vital air*; and at last Lavoisier, from an hypothesis respecting the formation of acids, distinguished it by the appellation of *oxygen gas*, which it now bears.

Its properties.

Oxygen gas possesses the mechanical properties of common air. It is colourless, invisible, and capable of indefinite expansion and compression.

Combustibles burn in it better and brighter than in common air. Animals can breathe it longer than common air without suffocation.

It has been ascertained, that one-fifth of the air of the atmosphere is oxygen gas, and that when this portion is abstracted, the air can neither support combustion nor animal life.

When substances are burnt in oxygen gas or air, or when animals breathe them, a portion of the oxygen always disappears, and, in some cases, even the whole of it.

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* The term *gas* is applied by chemists to all *airs* except *common air*.

Its specific gravity, according to Kirwan, is 1.103; according to Davy, 1.127; according to Fourcroy, Vauquelin, and Seguin, 1.087; according to Saussure, junior, 1.114, that of air being 1.000. At the temperature of 60°, and when the barometer stands at 30 inches, 100 cubic inches of common air weigh very nearly 30.5 grains troy. 100 cubic inches of oxygen in the same temperature and pressure, weigh, according to these results, 33. grains, 34.37 grains, 33.15 grains, and 33.97 grains troy.

It is not sensibly absorbed by water. 100 cubic inches of water freed from air by boiling, absorb 3.55 inches of this gas, according to the experiments of Dr Henry.

Oxygen is capable of combining with a great number of bodies, or it has an *affinity* for them, and forms compounds with them.

Sect. II. *Of Chlorine.*

Chlorine.

This substance was first discovered by Scheele, and called by him *dephlogisticated muriatic acid.* Berthollet, who made many important experiments on it, and who conceived it to be a compound of muriatic acid and oxygen, gave it the name of *oxymuriatic acid.* Mr Davy has lately made it the subject of investigation, and has published some very important dissertations on it. He has shewn, by decisive experiments, that we have no proof of its containing oxygen. This has induced him to revive the original opinion of Scheele respecting its nature, and convinced of the impropriety of the old names by which it was distinguished, and aware of the hazard of giving it a name from theoretical considerations, he has contrived the term *chlorine*, derived from the green colour, by which it may be distinguished from all other gaseous bodies.

How procured.

Chlorine may be obtained by distilling a mixture of muriatic acid and the black oxide of manganese; or by mixing together three parts of common salt, and two parts of black oxide of manganese in a glass retort, and pouring over them two parts of diluted sulphuric acid. When this mixture is heated, a green coloured gas makes its appearance, which may be collected in glass phials over water. This gas is the substance in question.

Its properties.

This gas has a yellowish green colour, its odour is extremely offensive and suffocating, and it cannot be breathed. When drawn into the lungs mixed with common air, it occasions a violent cough, which lasts for some time, accompanied with a sense of oppression and of weakness. It is capable of supporting combustion. Indeed, many substances, as phosphorus, antimony, &c. take fire in it of their own accord, without being kindled. Its specific gravity is 2.713, that of air being 1.000.

It is not altered by exposure to light, or to a red heat.

Water absorbs it slowly, and acquires a green colour, and the smell and properties of the gas. It may be frozen without losing the gas, but it is easily extricated by heat. When this liquid is exposed to the light, the chlorine disappears, oxygen gas escapes, and a portion of muriatic acid is found dissolved in the water.

Chlorine has the property of destroying vegetable blues, and other vegetable colours. This property has rendered it a valuable article in bleaching.

Euchloric gas.

Oxygen has the property of combining with chlorine, and of forming with it a peculiar yellow-coloured gas, hitherto not much examined. It was discovered by Mr Davy. To obtain it, the salt formed by passing a current of chlorine through a solution of carbonate of potash, a salt formerly distinguished by the name of hyper-oxymuriate of potash, is put into a flask, and diluted muriatic acid poured upon it. An effervescence takes place; and, by the cautious application of a very moderate heat, the combination in question comes over. Mr Davy proposes to distinguish this new gas by the name of euchloric gas, in consequence of the great intensity of its colour. Combustible substances do not act upon this gas so powerfully as upon chlorine. Indeed, the metals do not act upon it at all till it is decomposed. When exposed to a moderate heat, it is decomposed, and the expansion is accompanied by an explosion.

As far as we know at present, chlorine, like oxygen, is a simple substance; and it is, in some respects, a more powerful supporter of combustion than oxygen itself.

Like oxygen, it has an affinity for a great number of bodies, and forms peculiar compounds by uniting with them.

Chap. II.

Of Simple Combustibles.

Simple combustibles.

By *combustible* is understood a substance capable of burning; and by *simple combustibles*, bodies of that nature not yet decomposed. They are five in number, namely, *hydrogen, carbon, phosphorus, sulphur*, and *boracium.* It is not impossible that the bases of all or most of these substances are metals; but the opinion has not yet been made out in a satisfactory manner.

Sect. I. *Of Hydrogen.*

Hydrogen.

Hydrogen, like oxygen, is a gas. It was first called *inflammable air*, and Mr Cavendish must be considered as its real discoverer.

How procured.

It may be procured by putting some clean iron or zinc filings into a glass retort, and pouring over them sulphuric acid diluted with thrice its bulk of water. A violent boiling takes place, or, as chemists term it, an *effervescence*; gas issues abundantly from the beak of the retort, and may be received like the oxygen in glass vessels standing in a trough of water.

Its properties.

It is invisible and colourless, and possesses the mechanical properties of common air.

When prepared by the above process, it has a peculiar smell, ascribed at present to the presence of a little *oil*, formed by the action of the acid on the iron filings.

It is the lightest gaseous body known. Its specific gravity, according to Kirwan, is 0.0843; according to Lavoisier, 0.0756; according to Fourcroy, Vauquelin, and Seguin, 0.0887; according to Davy, 0.0744. According to these various estimates, 100 cubic inches under the mean pressure and temperature, weigh 2.56 grains, 2.306 grains, 2.705 grains, and 2.27 grains Troy. It is about 13 times lighter than common air.

No combustible substance will burn in it; and no animal can breathe it for any length of time without death.

Forms water,

It burns when touched with a red hot iron, or when brought near a flaming taper. The colour of the flame is yellowish, and it gives but little light. If it be previously mixed with half its bulk of oxygen gas, it burns instantaneously, and with a loud explosion like the report of a pistol. If the mixture be put into a strong glass cylinder, standing over water, and kindled by an electric spark, the whole of the two gases disappears, and the cylinder is filled with the water. If the vessel be standing over mercury, or be hermetically sealed, its inner surface becomes coated with pure water. This water was found by Cavendish equal in weight to the two gases. Hence it has been inferred, that water is a compound of oxygen and hydrogen in the proportion of 7.5 by weight of oxygen to 1 of hydrogen.

and muriatic acid.

When equal bulks of hydrogen and chlorine are mixed together in a glass vessel, no change takes place in the dark; but if the vessel be exposed to the sun, the mixture burns with an explosion. It burns also if an electric spark be passed through it. In both cases, the two gases disappear entirely; and there is found in their place a quantity of muriatic acid gas almost exactly equal to them in bulk. Now, the specific gravity of muriatic acid gas is almost exactly the mean of that of hydrogen and chlorine.—Hence the weight does not change sensibly. From this experiment it is inferred, that muriatic acid gas is a compound of chlorine and hydrogen, in the proportion of equal bulks of each in the gaseous state, or by weight of 97.24 chlorine
2.76 hydrogen

100.00

Hydrogen is not sensibly altered or absorbed by water. 100 cubic inches of water deprived of air absorb 1.53 inches of hydrogen, according to the experiments of Dr Henry.

Sect. II. *Of Carbon and Diamond.*

Carbon and diamond.

If a piece of wood be heated to redness in an iron bottle, or a crucible filled with sand, it is converted into a black brittle substance called *charcoal;* the properties of which are nearly the same from what wood soever it has been obtained, provided it has been exposed to a sufficiently strong heat.

Charcoal.

Charcoal is insoluble in water, and not affected (provided air be excluded) by the most violent heat that can be applied.

It conducts electricity, is not liable to putrify, deprives meat of its putrid taste and smell, and is an excellent tooth powder.

It absorbs moisture with avidity, and likewise common air, oxygen, and hydrogen gas; but less of the last than of the two former.

When heated to 802°, it takes fire; and, if pure, burns all away without leaving any residuum. If the experiment be made in a glass vessel filled with oxygen gas, and the charcoal be heated by means of a burning-glass, the bulk of the oxygen gas is not altered, but a portion of it is converted into another gas, possessing quite different properties. It renders lime-water milky, and is quite absorbed by it, and cannot be breathed without occasioning instant death. This gas is called *carbonic acid.* It very nearly equals in weight the charcoal and the oxygen which have disappeared. Hence it is considered as a compound of them; and, from the proportion of each employed, it is considered as composed of very nearly 28 parts of charcoal, and 72 of oxygen.

Forms carbonic acid.

When considerable quantities of charcoal are burnt in this manner, a portion of water also appears. Hence it is conceived, that charcoal contains a small portion of hydrogen. The constituent which constitutes by far the greatest part of it, is called *carbon.* This supposition is corroborated by the late experiments of Mr Davy. Carbon exists in two other states, namely, the diamond and plumbago.

Diamond.

2. The diamond is a precious stone, transparent, and often crystallized in a six-sided prism, terminated by six-sided pyramids. It is the hardest of all bodies. Its specific gravity is about 2.3. It is a non-conductor of electricity.

When heated to the temperature of 14° of Wedgewood's pyrometer, or not so high as the melting point of silver, it gradually wastes away and burns. It combines with nearly the same quantity of oxygen, and forms the same proportion of carbonic acid as charcoal. Hence it consists chiefly of carbon. From the experiments of Davy, it has been inferred, that it contains a minute portion of oxygen as one of its constituents. The other constituent is carbon.

Plumbago.

3. Plumbago, called also *black lead* and *graphite,* is well known as the substance of which pencils are made. It is dug out of the earth; it is of a dark blue colour, and has some metallic lustre; it is soft, brittle, and infusible. When heated to redness, it gradually wastes away, and is converted into carbonic acid, leaving a little iron behind. It seems a compound of pure carbon, with about one twentieth part of its weight of iron.

Neither charcoal, diamond, nor plumbago, provided they be pure, are affected by chlorine. They do not combine with it, and may be heated in it to whiteness, without undergoing any alteration.

Carbon combines with hydrogen, and forms a gas formerly called heavy *inflammable air,* now carbureted hydrogen. Various gases were formerly called *heavy inflammable air.* The three following are the chief:

Carbureted hydrogen.

1. *Carbureted hydrogen.* It rises spontaneously in hot weather from stagnant water; it is evolved during the distillation of pitcoal; it is invisible, and possesses the mechanical properties of common air. Its specific gravity is 0.5554. One hundred cubic inches weigh 16.93 grains. For complete combustion, it requires twice its weight of oxygen. The products are its own bulk of carbonic acid and wa-

ter. Hence its constituents are carbon and hydrogen. The following are nearly the proportions:

28 hydrogen
72 oxygen
———
100

The gas obtained from pit-coal by distillation, consists chiefly of this gas.

Carbureted hydrogen gas burns with a yellow flame, and gives out a great deal of light.

Olefiant gas.

2. When four parts of sulphuric acid, and one part of alcohol, are heated in a retort, a gas comes over called *olefiant gas*, or *super-carbureted hydrogen*. It is invisible; has a disagreeable smell; its specific gravity is 0.9745. It burns with a dense white flame, and great splendour, and requires thrice its bulk of oxygen for complete combustion. The products are water and twice its bulk of carbonic acid. Hence it has been concluded, that this gas is composed of

85 carbon
15 hydrogen
———
100

When this gas is mixed with chlorine over water, the bulk of the mixture diminishes rapidly; and an opal coloured substance, like oil, swims upon the surface of the liquid. This substance seems to be a compound of the two gases. It dissolves in water, alcohol, and ether, and gives these liquids a hot and aromatic taste. It dissolves likewise in nitric acid without effervescence; but in sulphuric acid it effervesces, and chlorine is emitted.

Carbonic oxide.

3. *Carbonic oxide*. When a mixture of equal parts of iron filings and dry chalk is heated to redness in an iron retort, a gas comes over, partly carbonic acid and partly carbonic oxide. The former is washed away by means of lime water.

Carbonic oxide gas is invisible; its specific gravity is 0.956. It burns with a deep blue flame, and gives out but little light. For complete combustion, 100 measures of it require 40 of oxygen gas. The product is 92 measures of carbonic acid. As the carbonic acid produced is almost equal to the weight of the carbonic oxide and oxygen consumed, it is presumed that there is no other product. Hence carbonic oxide is considered as a compound of carbon and oxygen in the following proportions:

39 carbon
61 oxygen
———
100

Phosgen gas.

When equal bulks of this gas and chlorine gas are exposed to a strong light over mercury, they combine and form a gas just half the bulk of the constituents. It possesses acid properties. Water decomposes it; and muriatic acid and carbonic acid are obtained. This curious gas was discovered by Mr John Davy. Its specific gravity is 3.669; and 100 cubic inches of it weigh, under the mean pressure and temperature, 111.91 grains. It combines with four times its bulk of ammoniacal gas, and forms a neutral salt. Alcohol absorbs about 12 times its bulk of this gas without decomposing it. Mr John Davy has given this remarkable compound the name of *phosgen* gas, because it is formed by the action of light or its two constituents.

Sect. III. *Of Phosphorus.*

Phosphorus.

How procured.

Phosphorus may be obtained by pouring acetate of lead into urine, mixing the white powder which precipitates with charcoal, and distilling it in an earthen retort by means of a violent heat. The beak of the retort ought be plunged under water. The phosphorus drops into the water like melted wax. It is usually obtained from burnt bones.

It was discovered in 1669, by Brandt, a chemist of Hamburgh; afterwards by Kunkel; and last of all by Boyle, who taught his operator, Godfrey Hankwitz, to make it; and he for several years was the only person that could make it.

Its properties.

Phosphorus, when pure, is semitransparent and yellowish, but when kept in water it becomes white and opake, and has some resemblance to white wax. It is soft, and may be easily cut with a knife. It is insoluble in water. Its specific gravity is 1.770.

It melts at the temperature of 99°. It cannot easily be melted in the open air without taking fire. If air be excluded, it evaporates at 219°, and boils at 554°.

When exposed to the air, it emits a white smoke with the smell of garlic, and is luminous in the dark. This smoke is more abundant the higher the temperature, and is occasioned by the gradual combustion of the phosphorus. In oxygen gas it is not luminous unless the temperature be as high as 80°. Hence we learn, that it burns at a lower temperature in common air than in oxygen gas. This slow combustion in the open air, renders it necessary to keep phosphorus in phials filled with water and well corked.

Phosphoric acid.

When heated to 148°, it takes fire and burns with a vivid white flame, and emitting a vast quantity of smoke. It leaves (if pure) no residuum, but the white smoke when collected is an *acid*, and is called *phosphoric acid*. If the combustion be conducted in a jar filled with oxygen gas, the oxygen will be found to diminish so much, that every 100 parts of phosphorus occasion the disappearing of 114 parts of oxygen. The acid formed weighs as much as the phosphorus and the oxygen which have disappeared. Hence it is considered as a compound of these two, in the proportion of 100 parts of phosphorus to 114 of oxygen.

Oxide of phosphorus.

Phosphorus is supposed capable of combining with a small portion of oxygen, and of forming a compound called *oxide of phosphorus*. It may be formed by putting a bit of phosphorus in a long glass tube, and exposing it to the heat of boiling water. It *sublimes* and lines the tube in fine white flakes. This substance is very combustible, and often takes fire of its own accord when exposed to the air.

When introduced into chlorine, phosphorus burns with a clear bluish white flame, and is converted into a solid white matter, which seems to consist of the two substances united. When this compound is placed in contact with water, it is converted into phosphoric acid and muriatic acid.

When phosphorus is melted by means of a burning

Phosphureted hydrogen.

glass in hydrogen gas, a portion of it is dissolved, and a new gas formed, first discovered by Gemgembre, and called *phosphureted hydrogen gas.* It has a fetid odour like the smell of putrid fish. It burns spontaneously, when it comes into contact with common air or oxygen gas. Water dissolves a small portion of this gas, and acquires a bitter taste and unpleasant odour. The phosphorus gradually precipitates, and the hydrogen at the same time separates from the water. When kept in a glass jar, it soon loses its property of burning spontaneously.

From the experiments of Mr Davy, we learn, that when hydrogen gas is converted into phosphureted hydrogen, its bulk does not alter; and from the experiments of Mr Dalton, it follows, that the weight of 100 cubic inches of it under the common pressure, and at the temperature of 60°, is 26 grains. From these data, it is easy to establish its composition. Its constituents are obviously,

phosphorus	91.23
hydrogen	8.77
	100.00

Phosphorus combines with charcoal, and forms a compound of an orange red colour, called phosphuret of carbon. Common phosphorus contains a portion of this compound, which remains behind when the phosphorus is burnt. It is a light flocky powder, without taste or smell. When heated sufficiently, it burns, and the charcoal remains behind.

The compounds which phosphorus forms with the other bodies, are distinguished by the name of *phosphurets.*

Phosphorus is very poisonous when used internally. It has been recommended as a medicine, and said to be very efficacious in restoring the force of young persons exhausted by sensual indulgence.

Sect. IV. *Of Sulphur.*

Sulphur.

Sulphur, distinguished also by the name of *brimstone,* has been known since the earliest ages.

Its properties.

It is a hard brittle substance, of a greenish yellow colour, without any smell, and with very little taste. It is a nonconductor of electricity, and becomes electric *negatively* by friction. Its specific gravity is 1.990. It is not altered by exposure to the air, nor is it soluble in water.

When heated to 170° it rises up in the form of a fine powder, which may be easily collected, and is called *flowers of sulphur.* It is then said to be *volatilized* or *sublimed.* It is obvious, from this property, that sulphur is a volatile substance.

Sulphuric acid.

When heated to about 218° it melts, becomes transparent, and looks like a brown coloured oil. At 560° it boils, and the vapour kindles as it exhales, and burns with a blue flame, and an extremely disagreeable smell. If it be set on fire, and plunged into a jar filled with oxygen gas, it burns with a strong violet flame. In both cases (provided the quantity of air or oxygen be sufficient) it burns away completely without leaving any residue. But if the fumes be collected, they are found to be an acid, which is known by the name of *sulphuric acid.* A portion of the oxygen disappears; and, from the experiments of Lavoisier, it follows, that the sulphuric acid formed is exactly equal in weight to the sulphur and the oxygen which have disappeared during the combustion. Hence it is concluded, that this acid is composed of these two substances united together.

Many experiments have been made to ascertain the composition of sulphuric acid exactly. The following is the result which appears most accurate. It was obtained by Berzelius.

100	sulphur
150	oxygen
250	

Sulphurous acid.

But sulphur does not always combine with so great a portion of oxygen. It usually burns with a blue flame, and the suffocating vapours which it emits may be collected in glass cylinders filled with mercury, and standing in a trough containing mercury. They constitute a gas called *sulphurous acid.* It contains less oxygen than sulphuric acid, being compounded of

100	sulphur
100	oxygen
200	

When sulphur is kept melted in an open crucible, it becomes gradually thick and viscid. If it be now poured into water, it assumes a purple colour, and remains for some days soft; but it gradually becomes brittle, and of a light violet colour. Its texture is fibrous, and its specific gravity 2.325. In this state it has been called *oxide of sulphur,* from an opinion that it has combined with a little oxygen, and that this addition has altered its properties. But this opinion has not been proved experimentally.

Lac sulphuris.

When sulphur is dissolved in any liquid, as in a solution of potash, and then precipitated by an acid, it is always in the state of a white powder, known by the name of *lac sulphuris.* This powder consists of sulphur combined with a little water. When the water is driven off by heat, the white colour of the sulphur disappears, and its natural yellow colour returns.

When a current of chlorine is made to pass through a quantity of flowers of sulphur, or when sulphur is heated in chlorine, it gradually disappears, and a beautiful red liquid appears in its place. Its specific gravity is 1.623. It smokes very strongly, has a strong smell, and is very volatile. It dissolves phosphorus readily. When mixed with water, it is decomposed, and a quantity of sulphur separates. This substance is obviously a compound of sulphur and chlorine. Water decomposes it; and, in that case, sulphuric and muriatic acids are formed.

Sulphureted hydrogen.

Sulphur combines readily with hydrogen gas, and forms a gas known by the name of *sulphureted hydrogen,* which was first described by Scheele.

It may be formed by mixing together *potash* and sulphur, and boiling them together in a glass flask. When sulphuric acid is poured into the yellowish coloured liquid that is formed, an effervescence takes place, and the gas may be collected in proper vessels. It is obtained pure by digesting sulphuret of antimony in muriatic acid.

Sulphureted hydrogen gas is colourless, and possesses the mechanical properties of common air. It has a strong fetid smell, like that of rotten eggs. It neither supports combustion, nor animal life. Its specific gravity, according to Kirwan, is 1.106; according to Thenard, 1.231; according to Davy, 1.147. Water absorbs about its own weight of this gas, and acquires a fetid smell, a sweetish nauseous taste, and many of the properties peculiar to acids.

When this gas is set on fire, it burns with a reddish blue colour, and deposits a quantity of sulphur. When the electric spark is passed through it, sulphur is deposited, but the bulk of the gas is not altered. Sulphur is also deposited when *nitric acid* is dropt into water impregnated with it. When mixed with oxygen gas, and burnt, the only substances formed are sulphuric acid and water. Hence it is obvious, that its constituents are sulphur and hydrogen.

From the experiments of Mr Davy we learn, that when sulphur is heated in hydrogen gas, a portion of sulphureted hydrogen is formed, but the bulk of the gas is not altered. Hence the specific gravity of the gas obviously gives us the proportion of its constituents. It must consist of

Sulphur	93.5
Hydrogen	6.5
	100.0

Supersulphureted hydrogen. Sulphur acts upon charcoal at a red heat. If a quantity of charcoal be put into a porcelain tube, and heated to redness, by passing it through a furnace, and sulphur be made to pass through it while in that state without any communication with the external air, a substance issues from the extremity of the tube, which may be obtained by means of a crooked glass tube luted to the porcelain tube, and plunged to the bottom of a glass vessel filled with water. This substance is a liquid, colourless and transparent when pure, but often tinged greenish yellow. Its taste is cooling and pungent, and its odour strong and peculiar. It does not dissolve in water. Its specific gravity is 1.3. In an exhausted receiver, or at the top of a barometrical tube, it assumes the gaseous form. It burns very easily, and detonates when mixed with oxygen gas and kindled. It was first discovered by Lampadius, and Clement and Desormes; and Berthollet, junior, investigated its properties. It is composed of sulphur and hydrogen, but contains more sulphur than sulphureted hydrogen. It may therefore be called *super-sulphureted hydrogen*.

Phosphuret of sulphur. Sulphur and phosphorus readily combine, and in various proportions; but the compound seems to be most intimate when the weights of the two ingredients are equal. The combinations may be made by mixing the two ingredients in a small phial and melting them together, or by cautiously heating them in a flask filled with water. But the first method is less hazardous; for the compound acts upon the water, and gases are formed, which sometimes occasion violent explosions. The compound has a yellowish green colour: it may be distilled over in a glass retort without decomposition. It has a tendency to the liquid form, which is greatest when equal proportions of the constituents are used. It then remains liquid in the temperature of 41°. When the sulphur predominates in this compound, it may be called *phosphuret of sulphur*; when the phosphorus, *sulphuret of phosphorus*. It is very combustible, and often takes fire spontaneously when exposed to the air.

From the experiments of Clayfield and Berthollet, junior, there is reason to conclude that sulphur contains a small quantity of hydrogen.

Sect. V. *Of Boracium.*

Boracium. This substance was discovered by Mr Davy, but it was first described by Thenard and Gay-Lussac. Mr Davy has lately published a more detailed account of its properties. How procured. To procure it, equal weights of the metal called *potassium* and dry *boracic acid* are to be put into a copper tube, and exposed for some minutes to a slight red heat. When cold, the mass is to be washed out with water, the potash saturated with muriatic acid, and the whole thrown upon a filter. An olive-coloured matter remains, which must be washed and dried. It is *boracium*.*

Its properties. Boracium is of a dark olive colour, opake, brittle, its powder does not scratch glass, it is a non-conductor of electricity, and has some resemblance to charcoal. When heated to whiteness in a metallic vessel, it remains unaltered, provided common air or oxygen be excluded. After this process it sinks in strong sulphuric acid; but in its ordinary state it swims upon that liquid.

Boracic acid. When heated in common air or oxygen gas, to a temperature not quite so high as 600°, it takes fire and burns with considerable brilliancy, somewhat like charcoal, and is converted into boracic acid. By this process, a portion of the oxygen disappears. Hence boracic acid is considered as a compound of boracium and oxygen. The exact proportion of the constituents of this acid have not yet been ascertained. According to Mr Davy's experiments, it is composed of one part boracium, and two parts oxygen; while Thenard and Gay-Lussac consider it as a compound of two parts boracium and one of oxygen.

When placed in contact with chlorine, it burns spontaneously with a white light, and is partly converted into boracic acid, partly into a black matter which is considered as an *oxide of boracium*. It burns when slightly heated, and is converted into boracic acid. It decomposes sulphuric and nitric acids with the assistance of heat, and is converted into boracic acid. When melted with sulphur and kept long in contact with it, a kind of combination takes place as the sulphur acquires an olive colour. It does not combine with phosphorus. Whether it combines with hydrogen and with charcoal, has not been tried.

Potash and soda dissolve it both when liquid and when melted with it in a crucible, forming pale olive compounds, which give dark-coloured precipitates when treated with muriatic acid. It did not combine with mercury by heat.

Mr Davy has rendered it probable that it contains a little oxygen, and that, when deprived of this principle, it combines with metals, and forms compounds capable of conducting electricity.

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* The French chemists have called it *bore*. *Boron* would be a better name than either.

Properties of the simple combustibles.

Such are the properties of the simple combustible bodies; none of which, unless hydrogen be an exception, are, strictly speaking, simple substances, though we are not in possession of any accurate method of separating their constituents, and exhibiting them in a separate state. It is very likely that the hydrogen and oxygen separated from several of them, may be owing to the presence of water in them, from which it is very difficult to separate them completely.

Two of them, *boracium* and *carbon*, are solids which we are incapable of melting or altering by heat; two of them, sulphur and phosphorus, easily melt, and may be exhibited in a solid, liquid, or even gaseous state; while one of them, hydrogen, is always, when pure, in the state of a gas.

They all combine with oxygen, but in different proportions, as is obvious from the following table, exhibiting the quantity of oxygen capable of combining with 100 parts of each.

100 Hydrogen unites with	750 oxygen.
100 Carbon	251.6
100 Boracium	200
100 Sulphur	150
100 Phosphorus	114

It has been supposed by some, that the affinity of different bodies for oxygen, is proportioned to the quantity of it with which they combine. According to this notion, the affinity of the simple combustibles for oxygen is in the order of the preceding table.

Chlorine has the property of combining with all the simple combustibles except carbon. With hydrogen it forms muriatic acid; with sulphur, phosphorus, and boracium, it forms compounds not yet distinguished by specific names.

Hydrogen unites with all the simple combustibles, unless boracium be an exception. It is probable that they are all capable of combining with each other, at least, in one proportion, and some are known to combine in several. Chemists have agreed to give such compounds a name derived from one of the ingredients and ending in *uret*, as *sulphuret of phosphorus*, *phosphuret of carbon*. When the compound is gaseous, the term is converted into an adjective, as *sulphureted hydrogen gas, carbureted hydrogen gas.*

CHAP. III.

Of Simple Incombustibles.

Simple incombustibles.

By simple incombustibles are meant all substances incapable of combustion which have not yet been decompounded. We are acquainted with only one body of that nature at present, namely, *azote.* There can be little doubt that it is a compound, though all attempts at a regular analysis of it hitherto failed.

SECT. I. *Of Azote.*

Azote.

1. Azote, called also *nitrogen*, which was first particularly pointed out by Dr Rutherford in 1772, constitutes four-fifths of the atmosphere. The other fifth is oxygen. To obtain it pure, we have only to deprive any portion of air of the whole of its oxygen. This is easily done by confining in it for some time a mixture of sulphur and iron filings made up into a paste, or a quantity of phosphorus.

How obtained.

Dr Priestley, who was one of the original experimenters on this substance, gave it the name of *phlogisticated air*. The French chemists called it at first *mofete*, and afterwards *azotic gas*, because animals cannot breath it without death. The name *azote*, though it has prevailed, is without doubt ill chosen.

Its properties.

Azotic gas is invisible, and possesses the mechanical properties of common air. Its specific gravity, according to Kirwan, is 0.985; according to Lavoisier, 0.978; according to Biot and Arago, 0.969; that of common air being 1.000.

It neither supports flame nor animal life. Water does not sensibly absorb it. 100 cubic inches of water, freed from air by boiling, absorb about 1½ inches of this gas.

2. Though incombustible, it is capable of combining with oxygen gas. When electric sparks are passed through a mixture of oxygen and azotic gases for some time, the bulk of the mixture diminishes, and an acid is formed. If the gases be mixed in the proper proportions, they disappear entirely, and are of course totally converted into an acid. This acid is the *nitrous*. Hence it follows, that nitrous acid is composed of oxygen and azote. This important discovery was made by Mr Cavendish. The result of his experiments gives us nitrous acid composed very nearly of 30 azote,
70 oxygen.

100

or one part azote united to 2⅓ of oxygen.

Nitrous acid.

Nitrous gas.

Nitric acid is a yellow corrosive liquid, of great importance in chemistry. It acts with great energy on most other bodies, in consequence of the facility with which it parts with its oxygen. If copper or silver, for example, be put into it, the metals absorb oxygen and dissolve. The portion of acid which loses a part of its oxygen, assumes the gaseous form, and makes its escape out of the liquid, occasioning an effervescence. The gas which escapes is a compound of azote, and a smaller proportion of oxygen than exists in nitric acid. It is usually called *nitrous gas.* It has the curious property of combining with oxygen gas whenever it comes in contact with it, and of thus being again converted into nitric acid. The mixture becomes yellow; and, if standing over water, its bulk diminishes very much, because the water absorbs the acid as it forms.

Gaseous oxide.

If iron filings be kept for some days in a jar of nitrous gas, its bulk diminishes, and it loses the property of becoming yellow when mixed with common air. Its properties are now changed, and it is called *gaseous oxide of azote.* This new gas is composed of the same constituents as the former, but it contains a smaller proportion of oxygen. It supports combustion, and bodies burn in it almost with as much splendour as in oxygen gas.

Thus it appears, that azote has the property of combining with three different doses of oxygen.

3. As far as we know at present, chlorine has not the property of combining with azote.

4. The combinations of azote with the simple substances are not numerous, but some of them are important.

Ammonia.

When putrid urine, wool, and many other animal substances, are distilled, among other products, there is obtained a substance of a pungent odour and taste, known by the names of *hartshorn*, *volatile alkali*, *ammonia*. It may be obtained pure, by heating a mixture of three parts of quicklime and one part of the salt called *sal ammoniac*, in a glass flask, and receiving the product over mercury. It is a gas. When electric sparks are passed through it, its bulk is doubled, and it is converted into a mixture of azotic and hydrogen gases. Hence it is a compound of these two substances. It consists of three parts by measure of hydrogen gas, and one part of azotic gas.

Azotic gas is said to have the property of dissolving a little charcoal, which it again deposites when allowed to stand over water.

It dissolves likewise a little phosphorus, and increases about one-fortieth part in bulk. When this phosphureted azotic gas is mixed with oxygen gas, it becomes luminous, in consequence of the combustion of the dissolved phosphorus.

Azotic gas is said likewise to dissolve a little sulphur when assisted by heat. Sulphureted azotic gas is said to resemble sulphureted hydrogen gas in its properties.

Chap. IV.

Of Metals.

Metals.

Metals, one of the most important classes of bodies, and to which we are indebted for most of our improvements, are very numerous. Indeed, the present state of chemical analysis leads to the opinion that all bodies will ultimately divide themselves into two sets; namely, *metals*, and supporters of combustion.

Properties.

1. Metals are distinguished by a peculiar lustre, well known by the name of the *metallic lustre*. They are perfectly opake or impervious to light, even in the thinnest plates to which they can be reduced. The only exception is gold leaf. Its thickness does not exceed $\frac{1}{180000}$th part of an inch, and it allows the light to pass through it. If other metals could be reduced as thin, it is probable that they also would be pervious to light. They may all be melted when heated sufficiently. Some, as mercury, require very little heat to melt them; while others, as platinum, require a great deal. Their specific gravity is exceedingly various. All the old metals are at least five times heavier than water; and some, as platinum, more than twenty times heavier. But some of the new metals discovered by Davy are much lighter than water. They are the best conductors of electricity of all known bodies. None of them is very hard; but some of them may be hardened artificially, so as to exceed most other bodies. Their elasticity may likewise, in some cases, be artificially increased. Some of them are *malleable*, or may be extended by the blows of a hammer, while others are *brittle*. Some of them are *ductile*, or may be drawn out into wire, while others cannot. They differ considerably from each other in their *tenacity*, or in the weight which they are capable of supporting without breaking.

Combine with oxygen,

2. Several of them take fire when heated, and burn with considerable splendour, and almost all of them may be burnt by peculiar contrivances. After combustion, their appearance is totally changed: They have lost the metallic lustre, and are converted into earthy-like powders, formerly called *calces*, and now *oxides*. These oxides are of various colours, white, red, yellow, blue, &c. according to the metal, and several of them are employed as paints. Most metals are converted into oxides, merely by exposing them for a sufficient length of time to the action of heat and air, and all by the action of acids.

When these oxides are mixed with charcoal powder, and heated, they lose their earthy-like appearance, and are restored again to the metallic state. This process is called *reduction*. Some metallic oxides, as those of gold and silver, require only to be heated in order to be *reduced;* but most of them require also the presence of charcoal, or of some other combustible substance. These oxides were at first considered as simple substances, and the metals were supposed to be composed of them and the principle of inflammability, called phlogiston. But it was shewn by the experiments of Lavoisier, that the oxides are compounds, and that they are composed of the metals from which they were obtained, united to oxygen. Thus, *oxide of gold* is a compound of gold and oxygen. It was the discovery of this fact that induced chemists to substitute the word *oxide* for calx.

Most metals are capable of combining with various doses of oxygen, and of forming various oxides, which it is of consequence to be able to distinguish. This may be done by prefixing to the term oxide the Greek ordinal numeral, expressing the peculiar oxide. Thus, *protoxide of tin* is the first oxide of tin, or tin combined with a minimum of oxygen. *Deutoxide of tin* is the second oxide of tin, or tin combined with two doses of oxygen. The terms *tritoxide, tetroxide, pentoxide*, &c. are to be understood in the same way. The last oxide of a metal is called *Peroxide*. *Peroxide* means a metal combined with as much oxygen as it can take up, or a metal saturated with oxygen.

and with combustibles.

3. Metals combine with the simple combustibles, and form compounds, many of which are of considerable importance. These compounds are denoted by a word formed from the simple combustible present, and terminating in *uret*. Thus, *sulphuret of tin* is a compound of sulphur and tin. In like manner, *carburet* and *phosphuret of iron*, means iron combined respectively with carbon and with phosphorus. Hydrogen gas dissolves some of the metals. These solutions are denoted by prefixing the metal converted into an adjective before the word hydrogen. Thus, *arsenical hydrogen gas* means a solution of arsenic in hydrogen gas. When hydrogen combines with a metal, and forms a solid compound, it is denoted by the term *hydroguret*.

4. The metals are not known to combine with simple incombustibles. But they combine with each other, and form a set of important compounds, called *alloys*. Thus *brass* is an *alloy* of copper and zinc; and *bell-metal* an *alloy* of copper and tin. When mercury is one of the metals combined, the compound is not called an alloy, but an *amalgam*. Thus, the amalgam of gold is gold dissolved in mercury.

5. The metals at present known (excluding the new ones discovered by Davy, which will be better described afterwards) amount to 27. They may be divided into the four following sets:

List of metals.

I. *Malleable.*

1. Gold.
2. Platinum.
3. Silver.
4. Mercury.
5. Palladium.
6. Rhodium.
7. Iridium.
8. Osmium.
9. Copper.
10. Iron.
11. Nickel.
12. Tin.
13. Lead.
14. Zinc.

II. *Brittle, and easily Fused.*

1. Bismuth.
2. Antimony.
3. Tellurium.
4. Arsenic.

III. *Brittle, and difficultly Fused.*

1. Cobalt.
2. Manganese.
3. Chromium.
4. Molybdenum.
5. Uranium.
6. Tungsten.

IV. *Refractory.*

1. Titanium.
2. Columbium.
3. Cerium.

The fourth set consists of metals which have not hitherto been obtained in quantities, except in the state of oxides. Formerly the brittle metals were called *semimetals*, and the malleable, *metals*. The first four malleable metals were once considered as *noble*, because their oxides may be reduced by mere heat.

Sect. I. *Of Gold.*

Gold.

Gold seems to have been the first known of all the metals. As it occurs always in the metallic state, and is very soft and ductile, less skill would be necessary to work it.

Properties.

1. Gold has a yellow colour, considerable lustre, and is destitute of taste or smell. It is very soft. Its specific gravity is 19.376, that of water being 1.000. It is the most ductile and malleable of all known bodies. It may be beaten out into leaves only $\frac{1}{280000}$th part of an inch in thickness, and drawn out into wire extremely fine. Its tenacity is considerable; a gold wire, 0.078 inch in diameter, being capable of supporting 150.07 lbs. avoirdupois without breaking.

It melts at 32° Wedgewood, and, when melted, has a bluish green colour. It does not sensibly waste nor alter, though kept very long in the state of fusion. In very violent heats, however, it has been perceived to be partially volatilized. When carefully cooled after fusion, it sometimes crystallizes in four-sided pyramids. Gold is not altered by exposure to the air; it does not even lose its lustre.

Oxides.

2. It combines with oxygen, and forms different oxides, the number and properties of which are but imperfectly known. Two have been described. The first, or the purple, is formed when violent electrical explosions are passed through gold leaf, or when gold is subjected to combustion. It is probably a compound of 100 gold and 8 oxygen.

The second, or peroxide, is of a yellow colour. It may be obtained by dissolving gold in nitro-muriatic acid, and then precipitating the metal by means of lime-water. It falls in the state of this yellow oxide. When carefully washed and dried, it is insoluble in water, and tasteless. From an experiment of Proust, we may infer, that it is composed of 100 gold and 32 oxygen.

It combines with chlorine, and forms the yellow-coloured, deliquescent, strong-tasted salt, at present distinguished by the name of *muriate of gold*.

3. Hitherto gold has been united with only one of the simple combustibles, namely phosphorus. Hydrogen and charcoal are said to precipitate it from its solutions in the metallic state. With sulphur it does not combine. The action of boracium has not been tried.

Phosphuret.

The compound of phosphorus and gold is called *phosphuret of gold*. It may be formed by dropping small pieces of phosphorus into gold in fusion. It is brittle, whiter than gold, and contains $\frac{1}{24}$th of phosphorus. The phosphorus may be dissipated by exposing the compound to a sufficient heat.

4. As far as is known, gold does not combine with azote.

5. It combines readily with most of the metals, and forms a variety of alloys.

Alloys.

Gold is so soft, that it is seldom employed quite pure. It is almost always alloyed with a little copper or silver. Goldsmiths usually announce the purity of gold in the following manner. Pure gold is divided into 24 parts, called *carats*. Gold of 24 carats, means pure gold; gold of 23 carats, means 23 parts of gold alloyed with 1 part of some other metal; gold of 22 carats, 22 parts of gold alloyed with 2 parts of some other metal. The number of carats mentioned specifies the pure gold, and what that number wants of 24 indicates the quantity of alloy. The gold coin of this country, or *sterling* gold, as it is called, is gold of 22 carats. Jewellers' gold is gold of 18 carats.

Sect. II. *Of Platinum.*

Platinum.

Platinum, which approaches to gold in many of its properties, was unknown in Europe as a peculiar metal till 1749. Hitherto it has been found only in South America, in St Domingo, and in the silver mine of Guadal-canal in Spain. For the first accurate investigation of its properties, we are indebted to Dr Lewis; and since his time it has been investigated by a great number of very eminent chemists.

It is brought from America in small flat grains, having a silvery lustre. These grains, besides platinum, contain no less than eight other metals. The platinum may be obtained pure, by dissolving the grains in nitro muriatic acid, and pouring a solution of *sal ammoniac* into the liquid. An orange yellow precipitate falls. This precipitate is to be washed and dried, and exposed to a red heat. The powder which remains is pure platinum. It may be amalgamated with mercury; and, by cautious heating and hammering, it may be reduced into an ingot.

Properties.

1. Platinum has a white colour like silver, but not so bright. It is as hard as iron. Its specific gravity, when hammered, is at least 23, so that it is the heaviest of all known bodies. It is very ductile and malleable. A platinum wire of the diameter 0.078 inch, is capable of supporting 274.31 lbs. avoirdupois without breaking. It is very difficult of fusion, and indeed cannot be melted in any quantity by the greatest heat which we can produce. But at a white heat, pieces of platinum may be welded together like pieces of hot iron. It is not altered by the action of heat and air.

Oxides.

2. Platinum cannot be converted into an oxide by the action of heat and air; we must have recourse to the action of acids. There are two oxides of platinum known: the protoxide is green, the peroxide brown.

The peroxide may be obtained by pouring lime water into the solution of platinum in nitro-muriatic acid. The brown powder which precipitates is to be dissolved in nitric acid, the solution evaporated to dryness, and the acid driven off by a cautious application of heat. The brown powder which remains is the peroxide. It is tasteless, insoluble in water, and decomposed by a red heat. It is composed, according to Mr Chenevix's experiments, of

87 platinum,
13 oxygen.

100

If the peroxide is gradually heated, it assumes a green colour, owing to the separation of a quantity of oxygen. This green powder is the protoxide, composed of

93 platinum,
7 oxygen.

100

Chlorine combines with platinum, and forms the dark brown substance distinguished by the name of muriate of platinum.

Phosphuret.

3. The simple combustibles have but little action on platinum. Neither hydrogen nor carbon unites with it. Phosphorus combines readily, and forms a *phosphuret*. It may be obtained by projecting phosphorus on red hot platinum. Its colour is silver white; it is very brittle and hard, and easily melts. The phosphorus may be driven off by heat. Platinum cannot be made to unite with sulphur. In this respect it resembles gold.

4. Azote does not combine with platinum.

Alloys.

5. It combines with most of the other metals, and forms alloys, first examined by Dr Lewis.

Gold unites to it, but a strong heat is necessary to combine them uniformly. Platinum alters the colour of gold very much. An alloy of four parts of gold and one of platinum has the colour of pure platinum. The colour is much affected, unless the platinum be less than $\frac{1}{17}$th of the gold. If such an alloy be digested in nitric acid, the platinum is dissolved. Thus it is easy to detect any attempt to debase gold by the addition of platinum.

SECT. III. *Of Silver.*

Silver.

Silver seems to have been known almost as early as gold.

Properties.

1. It has a fine white colour, with a shade of yellow, and is remarkably brilliant when polished. It is rather harder than gold. Its specific gravity is about 10.510. In malleability and ductility, it is inferior to none of the metals except gold. It may be hammered out into plates not more than $\frac{1}{100000}$th of an inch thick, and drawn out into wire finer than a human hair. A silver wire 0.078 inch thick, is capable of supporting 187.13 lbs. avoirdupois, without breaking. It melts when thoroughly red hot, or at the temperature of 22° Wedgewood. By a very violent heat it may be boiled, and partly volatilized. When cooled slowly, it crystallizes in four-sided pyramids.

Oxides.

2. By very long exposure to heat and air, silver may be oxidized; but the process is so tedious and difficult, that we cannot have recourse to it. There are two oxides of silver known, both of which have an olive green colour.

The peroxide may be formed by dissolving silver in nitric acid, and precipitating, by means of lime water. The powder which falls, when washed and dried, is the peroxide. It is tasteless and insoluble in water. When exposed to light or to heat, it is decomposed, and the silver reduced. It is composed of about

92.67 silver,
7.33 oxygen.

100

The protoxide may be formed by heating the solution of silver in nitric acid, in contact with a quantity of granular silver. It resembles the peroxide in colour, but its combination with nitric acid is more soluble.

Chlorine combines with silver, and forms with it the white-coloured, insoluble, and tasteless substance, at present distinguished by the name of muriate of silver.

3. Neither hydrogen nor carbon have been combined with silver; but it combines readily with sulphur and phosphorus.

Sulphuret.

When thin plates of silver and sulphur are laid alternately in a crucible, they melt by a moderate heat, and form sulphuret of silver. This compound is found in silver mines, or it exists *native*, as mineralogists term it. It has a dark grey colour, a metallic lustre, and the softness, flexibility, and malleability of lead. Its specific gravity is 7.2. It is composed of 87.27 silver, and 12.73 sulphur. When silver plate is long exposed, it contracts a thin covering of this substance. Hence the tarnish of silver is owing to its combining with sulphur.

Phosphuret.

Phosphuret of silver may be formed by projecting phosphorus into melted silver. It is white, composed of grains, breaks under the hammer, but may be cut with a knife. It is composed of four parts of silver and one of phosphorus. Heat decomposes it, by dissipating the phosphorus.

4. Silver does not combine with azote.

5. It combines readily with most of the metals.

Alloys. When gold and silver are melted together, they combine spontaneously, in the proportion of one part of silver and five of gold. They may, however, be melted together, and mixed in any proportion whatever. This alloy is harder and more sonorous than pure gold. Its hardness is a maximum when the alloy consists of two parts gold and one silver. The density of the alloy is a little diminished, and the colour of the gold is much altered, even when the proportion of silver is small. It is not only pale, but has a very sensible greenish tinge.

Silver and platinum may be combined by fusion, and form a hard alloy, not so ductile as silver. The two metals separate when the alloy is kept in fusion. Hence there appears but little affinity between them.

SECT. IV. *Of Mercury.*

Mercury. *Mercury*, called also *quicksilver*, was known to the ancients, and applied by them to the same purposes as it is by the moderns.

Properties. 1. Its colour is white, like that of silver; it has a good deal of lustre, and is destitute of taste and smell. Its specific gravity is 13.568. At the common temperature of the atmosphere, it is always in a state of fluidity. But if it be cooled down to 39° below zero, it becomes solid like any other metal. The congelation of mercury by cold was accidentally discovered by Professor Braun, at Petersburgh, in 1759. The freezing point was ascertained by Mr Hutchins, at Hudson's Bay, in consequence of the directions of Mr Cavendish. Solid mercury is malleable; but neither the degree of its malleability nor its ductility have been ascertained by experiment. Mercury boils when heated to 656°. Its vapour is invisible and elastic like air. It may be easily distilled over in proper vessels, and by this means is obtained pure.

Oxides. 2. Mercury is not altered by being kept in water. But when long agitated in air, or when kept heated in the open air, it gradually loses its metallic appearance, and is oxidized. Only two oxides of mercury have been yet ascertained in a satisfactory manner, the *protoxide*, which is *black*, and the *peroxide*, which is *red*.

The protoxide is a black powder, which may be obtained by agitating mercury for a long time in a stout phial; or by heating the salt called *calomel*, or *muriate of mercury*, with a solution of potash. It is black, insoluble in water, and contains about 5 per cent. of oxygen.

The red oxide, called also *red precipitate*, may be obtained by keeping mercury for several days, nearly at the boiling point, in a tall glass vessel, so contrived as to prevent the evaporation of the mercury, and admit a communication between the interior of the vessel and the atmosphere. The mercury becomes at first black, and gradually changes to red. It may be formed more speedily and easily by dissolving mercury in nitric acid, evaporating the solution to dryness, and heating the dry salt gradually, almost to redness, in a crucible or capsule. Nitric acid fumes exhale, and the whole assumes a fine red colour. The red oxide of mercury has an acrid and disagreeable taste, acts as an escharotic, and possesses poisonous qualities. When heated with zinc or tin filings, it sets them on fire. It contains about 10 per cent. of oxygen. When heated it gives out oxygen gas, and the mercury is reduced.

3. Mercury does not combine with hydrogen or carbon; but unites readily with sulphur and phosphorus.

Sulphurets. When two parts of sulphur and one of mercury are triturated together in a mortar, they gradually assume the appearance of a black powder, formerly called *æthiops mineral*. The same compound is formed by adding mercury slowly to its own weight of melted sulphur. When formed by the first process, the powder is black, but a microscope detects in it small globules of mercury; when formed by the second process, the powder is black, with a shade of purple. This compound has been ascertained to consist of mercury and sulphur united together, in what proportion is not well known.

When this black sulphuret is exposed to a red heat in a glass vessel, it sublimes and forms a cake of a fine scarlet colour. In this state it is usually called *cinnabar*, and when reduced to a fine powder, *vermilion*. It is well known as a red paint. Its specific gravity is about 10. It is tasteless, insoluble in water and in muriatic acid. When suddenly heated it burns with a blue flame. When mixed with iron filings, and distilled, it is decomposed, and running mercury obtained in the receiver. It is composed of about 85 parts mercury and 15 sulphur.

When phosphorus is mixed with the black oxide of mercury, and exposed to heat, the mixture readily combines, forming a black mass, which seems to be phosphureted oxide of mercury. At least phosphorus and mercury do not unite when heated together.

4. Mercury does not unite with azote.

Amalgams. 5. It combines with most metals, and forms compounds called *amalgams*.

The amalgam of gold is formed very readily by throwing small pieces of red hot gold into hot mercury. The two metals combine in any proportion. The amalgam is white and fluid if the mercury exceed. But by squeezing it through leather, the excess of mercury separates, and a solid amalgam remains, of the consistence of butter, which gradually crystallizes. It consists of one part of mercury to two of gold. This amalgam is much used in gilding.

The amalgam of platinum may be formed by triturating the powder of platinum with mercury, adding gradually a portion of either ingredient, till the combination is completed. When the process of amalgamation is once begun, it goes on easily. This amalgam has the consistence of butter, a white colour, much lustre, and does not tarnish by keeping. The mercury may be driven off by heat.

The amalgam of silver may be made in the same manner as that of gold, and with equal ease. It has a white colour, is always soft, and crystallizes.

All these amalgams are decomposed, and the mercury driven off by heat.

Sect. V. *Of Palladium.*

Palladium.

This metal was lately discovered by Dr Wollaston, in crude platina. Mr Chenevix announced soon after that he had succeeded in forming this metal artificially, by combining together platinum and mercury; but as nobody has been able to repeat his experiment with success, we must suppose him mistaken.

To obtain palladium, dissolve a sufficient quantity of crude platina in nitro-muriatic acid, and pour a solution of the salt called *prussiate of mercury* into the liquid. A yellowish white powder falls. When this powder is washed and dried, and exposed to a red heat, it leaves a white matter, which is *palladium*. When strongly heated with sulphur and borax, it may be melted into a button.

Properties.

1. Palladium thus obtained is a white metal, very like platinum in its appearance. Its specific gravity, when hammered, is 11.871. It is as malleable as platinum, breaks with a fibrous fracture, and appears of a crystallized texture. It is not altered by exposure to the air, and a very violent heat is necessary to fuse it.

2. When kept strongly heated, its surface acquires a blue colour. This is supposed a commencement of oxydizement. A more violent heat makes it resume the original metallic appearance. Sulphuric, nitric, and muriatic acids dissolve a portion of it when assisted by heat, and assume each a red colour. Nitro-muriatic acid is the best solvent of it.

3. Neither hydrogen nor carbon combine with this metal. But when brought into contact with sulphur while red hot, it melts immediately, and the sulphuret formed continues in fusion till only obscurely red. It is rather paler than the pure metal, and very brittle.

4. The simple incombustibles do not combine with palladium; but it unites with the metals, and forms alloys, which have been examined and described by Mr Chenevix.

Sect. VI. *Of Rhodium.*

Rhodium.

This metal exists also in crude platina, and was discovered by Dr Wollaston still more recently than the last.

How procured.

The process followed by Dr Wollaston for obtaining it, is somewhat complicated. Crude platina is dissolved in nitro muriatic acid, and the platinum precipitated by sal ammoniac. A piece of clean zinc is immersed into the residuary solution, which throws down a black powder. This black powder is digested with dilute nitric acid in a very gentle heat, to dissolve some copper and lead with which it is frequently contaminated. It is then dissolved into nitro-muriatic acid, common salt is added to the solution, and the whole is gently evaporated to dryness. The residuum is washed repeatedly with small quantities of alcohol, which dissolves two salts, consisting of the oxides of platinum and palladium in combination with common salt. There remains behind a deep red-coloured substance, consisting of the oxide of rhodium united to common salt. By solution in water, and gradual evaporation, rhomboidal crystals of a deep red colour are obtained. These crystals being dissolved in water, and a plate of zinc immersed into the solution, a black powder precipitates, which being strongly heated with borax, becomes white, and assumes a metallic lustre. In this state it is *rhodium*.

Propertie

1. Rhodium thus obtained, is white. Its specific gravity exceeds 11. No degree of heat hitherto applied is sufficient to melt it. Of course its malleability and other similar properties are unknown.

2. It is not oxidized by exposure to heat and air. Neither is it much acted on by acids. The only oxide of rhodium known is of a yellow colour. It may be obtained by dissolving the red crystals mentioned above, and precipitating by means of potash. This oxide, when dissolved in nitric or muriatic acid, does not crystallize.

3. It unites readily with sulphur, and by that means is easily melted. When the sulphur is driven off by heat, the metallic button obtained is not malleable. The action of the other simple combustibles is not known.

4. It does not combine with the simple incombustibles. It forms alloys with all the metals tried by Dr Wollaston, except mercury, with which it does not combine. It does not, like platinum and palladium, destroy the colour of gold when alloyed with it.

Sect. VII. *Of Iridium.*

Iridium.

How procured.

This metal was discovered by Mr Smithson Tennant, in 1803. Attempts were made by Descostils, and by Fourcroy and Vauquelin soon after, to obtain the same metal, but they succeeded but imperfectly.

When crude platina is dissolved in nitro-muriatic acid, a black powder remains, which preceding chemists considered as plumbago, but which Mr Tennant ascertained to be a compound of two new metals. When kept for some time in a red heat, mixed with its own weight of potash in a platinum crucible, water poured on the mixture forms a deep orange-coloured solution. Muriatic acid being digested on the powder which remains, becomes first blue, then green, and at last deep red. By repeated fusions with potash, and digestions in muriatic acid, the whole of the black powder is decomposed and dissolved. The potash solution contains the metal called *osmium*; the muriatic acid solution the metal called *iridium*.

A piece of zinc being put into this last solution, precipitates a black powder; when heated it becomes white, and is *iridium*.

Propertie

1. It has the appearance of platinum, and seems as difficult of fusion as that metal. It resists the action of acids, even the nitro-muriatic, almost completely.

2. Its affinity for oxygen seems weak; but, like other metallic bodies, it unites with that principle. The change of colour which its solution in muriatic acid assumes, seems to prove that it is capable of combining with different dozes of oxygen. When the colour is *blue*, the metal seems oxidized to a minimum; when *red*, it seems oxidized to a maximum.

3. The simple combustibles do not seem to com-

bine with iridium. Mr Tennant did not succeed in his attempt to unite it with sulphur.

4. It formed alloys with all the metals tried except arsenic. It does not alter the colour of gold, and cannot be separated from gold and silver by cupellation.

SECT. VIII. *Of Osmium.*

Osmium. This metal was discovered by Mr Tennant at the same time with the preceding. It exists in the black powder separated during the solution of crude platina, and may be obtained in solution in potash, by the process described in the last Section. When sulphuric acid is mixed with this solution, and the whole subjected to distillation, a colourless liquid comes over, consisting of water, holding the oxide of osmium in solution. It has a peculiar smell. Hence the name *osmium* applied to the metal. When mercury is agitated in this solution, the osmium combines with it, and leaves the water, and by applying heat, the mercury is driven off, and the metal obtained in a state of purity.

Properties. 1. Osmium has a dark grey or blue colour, and the metallic lustre. In the open air it is easily dissipated by heat; but in close vessels, it resists any degree of heat without alteration. It is not acted on by any acid, not even the nitro-muriatic, but is easily obtained in solution by the action of potash.

2. Osmium is easily oxidized by heat in the open air. The oxide has a peculiar smell, and a kind of oily appearance. It is volatile and soluble in water. The solution is colourless, does not alter vegetable blues, and strikes first a purple, then a blue, with the infusion of nut-galls.

3. The action of the simple combustibles on this metal is not yet known. Neither do we know much of its combination with other metals. It amalgamates with mercury, and Mr Tennant united it by fusion with copper and gold.

SECT. IX. *Of Copper.*

Copper. Copper seems to have been known as early as any metal except gold and silver. It was very much employed by the ancients before the method of manufacturing steel became familiar.

Properties. 1. Copper has a fine red colour, but it soon tarnishes when exposed to the air. Its taste is styptic and nauseous, and when rubbed it emits a disagreeable odour. It is very poisonous when taken internally. It is softer than iron, but harder than gold. Its specific gravity, when pure, is about 8.9. Its malleability and ductility are very considerable. A copper wire 0.078 inch in diameter is capable of supporting 302.2 lbs. avoirdupois without breaking. It melts at 27° Wedgewood, and gradually evaporates in visible fumes. When melted, it has a bluish green colour, something like that of melted gold. When allowed to cool slowly, it crystallizes in quadrangular pyramids.

Oxides. 2. It is not altered though kept under water. When heated in contact with air, it is gradually converted into a black oxide by the combination of oxygen. Before a blow-pipe of oxygen and hydrogen gases, it burns with a fine green flame. There are two oxides of copper. The protoxide is found naturally of a red colour, but when formed artificially it is orange. The peroxide is black.

The protoxide was first recognised by Mr Proust. It may be prepared by beating together a mixture of equal parts of black oxide and copper in powder in muriatic acid. Almost the whole is dissolved, and the solution is colourless. By pouring potash into the solution, the protoxide precipitates in the state of a yellow powder. This oxide is composed of 88.89 parts copper, and 11.11 oxygen. It attracts oxygen with such avidity, that it can scarcely be dried without becoming black.

The peroxide of copper is easily formed by keeping copper filings a sufficient time red hot. It contains 80 parts copper, and 20 oxygen. It is black. It combines with water, and forms a blue-coloured matter called *hydrate of copper.*

3. Copper has not been combined with hydrogen or carbon; but it unites with sulphur and phosphorus, forming the *sulphuret* and *phosphuret of copper.*

Sulphurets. When equal parts of sulphur and copper are stratified in a crucible, they combine at a red heat, and form sulphuret of copper, of a very deep blue colour. It is brittle, and composed of 78 copper and 22 sulphur. If copper filings and sulphur in powder be mixed, and gradually heated in a flask, they combine before they are heated to redness; but at the instant of combination, a quantity of heat is evolved sufficient to convert the sulphuret into a glowing red, as if in a state of vivid combustion.

Sulphuret of copper is capable of combining with an additional dose of sulphur, and forming a *supersulphuret.* It is brittle, has a yellow colour, and the metallic lustre. It is found native, and known under the name of *copper pyrites.*

Phosphurets. Phosphuret of copper may be formed by projecting phosphorus on red hot copper. It is white, tough but not ductile, hard, and contains the 5th of its weight of phosphorus. When repeatedly melted, it still retains about 1-12th of its weight of phosphorus, and then has much the appearance of steel, and admits of an equally fine polish.

4. Copper does not combine with azote.

Alloys. 5. It combines with most of the metals, and some of its alloys are of considerable importance.

Copper unites readily with gold, and even heightens the colour, while it increases the hardness, and does not injure the ductility. Gold coin consists of gold alloyed with copper or silver, or with both. Our coin contains 1-12th of alloy, usually both silver and copper. A pound of standard gold is coined into 44½ guineas.

Platinum combines with copper, but a violent heat is necessary. The alloy is white, hard, ductile, takes a fine polish, and is not liable to tarnish. Hence it has been proposed for the mirrors of telescopes.

Copper and silver easily unite by fusion. The alloy is harder and more sonorous than silver, and retains its white colour even when the proportion of copper is considerable. Our silver coin consists of 12⅓ silver, alloyed with one of copper. A pound of standard silver is coined into 62 shillings.

Copper may be united to mercury by pouring a small stream of it melted into mercury, heated nearly to the boiling point; or by keeping plates of copper in a solution of mercury in nitric acid. It is white, and at first soft, but gradually hardens when exposed to the air.

Sect. X. *Of Iron.*

Iron. Iron was not known at so early a period as gold, silver, and copper. The art of working it was discovered in the East, and first communicated to the Greeks by the Phrygians, from whom it gradually made its way through the rest of Europe.

Properties. 1. Iron has a bluish white colour, a styptic taste, and emits a smell when rubbed. It is one of the hardest of the metals. Its specific gravity varies from 7.6 to 7.8. It is attracted by the magnet or loadstone, and is itself the substance which constitutes the loadstone. When iron is perfectly pure, it retains the magnetic virtue but a short time.

It is malleable in every temperature, and its malleability increases with the temperature. It cannot be hammered into so thin plates as gold or silver. But it may be drawn out into very fine wire. An iron wire of 0.078 inch in diameter is capable of supporting 549.25 lbs. avoirdupois without breaking. When heated to 158° Wedgewood, it melts; a temperature so high, that it is difficult to go much beyond it.

Oxides. 2. It is much more easily converted into oxide than any of the metals described in the preceding Sections. When left exposed to the air, especially in a moist place, it is soon converted to a red or yellow powder, called *rust*, which is nothing else than an *oxide* of iron usually combined with carbonic acid. When kept under water, especially in warm weather, it is gradually converted into a black brittle matter, which is also an oxide, while some hydrogen gas is disengaged, owing to the decomposition of the water. If vapour of water be passed through red hot iron, the iron is rapidly oxidized and much hydrogen gas is obtained. If an iron wire, having a small bit of lighted cotton at its extremity, be plunged into a jar of oxygen gas, it burns with great brilliancy, and is converted into the same black oxide, which falls to the bottom of the jar in melted drops.

There are two oxides of iron, which have been ascertained in a satisfactory manner. The *black* oxide may be obtained, by keeping iron filings a sufficient time in water, by making steam pass through iron filings at a red heat, by burning iron wire in oxygen gas, or by dissolving iron in diluted sulphuric acid, and dropping potash into the solution. It is a black powder, insoluble in water, is attracted by the magnet, and has a good deal of metallic lustre. It is a compound of 78.5 parts iron and 21.5 oxygen.

The *red oxide*, or *peroxide*, may be obtained, by keeping iron filings red hot in an open vessel, and agitating them constantly till they are converted into a red powder; or by exposing a solution of iron in sulphuric acid for a long time to the atmosphere, and then precipitating by means of potash. It is a red powder, insoluble in water, and constitutes the base of several of the common red paints. Clay and bricks owe to it their yellow and red colours. It is composed of 69 iron and 31 oxygen.

3. Iron seems capable of combining with all the simple combustibles. Hydrogen, indeed, has never been united to it in a solid state, but hydrogen gas dissolves a little iron, which it gradually deposits when kept over water.

Carburet. Carburet of iron is found native, and is the substance mentioned in a preceding Section under the name of *plumbago*, or *black lead*. It is a soft substance, of a dark blue colour, a granular texture, and the metallic lustre. It does not burn with a flame, but gradually wastes away when kept red hot. When thrown into melted nitre, a very splendid combustion is produced. Its nature was first developed by Dr Lewis, and afterwards more fully explained by Scheele and the French chemists. It seems to consist of about 19 parts of carbon, and one of iron.

Phosphurets. Phosphuret of iron may be formed by dropping bits of phosphorus upon red hot iron. Its colour is dark steel grey, it is very brittle, and does not easily dissolve in acids. It exists in different ores of iron, and is considered as giving to the variety of iron called *cold short iron*, the property of being brittle while cold, though it be malleable while hot. Phosphuret of iron was at first considered by Bergman as a peculiar metal, and called *siderum*.

Sulphurets. Sulphuret of iron may be formed, by melting together in a crucible equal parts of iron filings and flowers of sulphur. It is of a black or very deep grey colour, brittle, and very hard. When the two constituents of it combine, a great quantity of heat is evolved, which makes the whole strongly red hot. This sulphuret is composed of 63 iron and 37 sulphur. It exists native, and is known by the name of *magnetic pyrites*. Its colour is that of bronze; it has the metallic lustre, but its powder is blackish grey. Its specific gravity is 4.518. It strikes fire with steel, and easily melts when heated. It is not only magnetic, but is itself capable of being converted into a permanent magnet, as Mr Hatchett discovered.

Iron is capable of combining with a still greater proportion of sulphur, and of forming a compound which may be called *super-sulphuret of iron*. It occurs native in great abundance, and is known by the name of *pyrites*, or *iron pyrites*. It is yellow, has the metallic lustre, is brittle, strikes fire with steel, and is often crystallized in cubes. Its specific gravity is 4.5. When distilled, it loses its excess of sulphur, and is converted into common sulphuret of iron. By this process, sulphur is sometimes obtained for the purposes of manufactures. Pyrites is composed of 80 common sulphuret of iron and 20 sulphur, or more exactly of about 47 iron and 53 sulphur. The super-sulphuret is not magnetic, nor susceptible of becoming a magnet. Mr Hatchett found, that phosphuret of iron is also capable of magnetic impregnation; and it is well known that iron containing a portion of carbon, or *steel*, possesses the same property in perfection. Hence Mr Hatchett concludes, that permanent magnets consist of iron, combined with a certain proportion of a simple combustible. But, when saturated with simple combustibles, it loses its magnetic properties entirely. This is known with respect to iron saturated with sulphur and carbon, and is probable with respect to iron saturated with phosphorus. The subject requires and deserves farther investigation.

There are a great many varieties of iron, which artists distinguish by different names; but they may be all reduced under the following classes: *Cast iron*, *wrought* or *soft iron*, and *steel*.

Cast iron.

Cast iron, or *pig iron*, is the name of the metal when first extracted from its ores. The ores of iron commonly used, are a mixture of the oxide of the metal and clay. They are reduced to small pieces, and exposed to a violent heat, mixed with charcoal and lime. The charcoal separates the oxygen, while the lime, combining with the clay, forms a liquid through which the melted iron falls, and is collected at the bottom of the furnace. It is let out and cast in moulds. The cast iron thus obtained, varies considerably according to circumstances. Three varieties have been well distinguished; namely, *white* cast iron, which is very hard and brittle; *grey* or *mottled*, which is softer and less brittle; and *black*, which is the softest and most fusible. Cast iron melts at 130° Wedgewood. Its specific gravity varies from 7.2 to 7.6. It contracts considerably when brought into fusion.

Cast iron is converted into *wrought or soft iron*, by keeping it melted for a considerable time in a bed of charcoal and ashes, and the *scoriæ* or *black oxide* of iron, and then forging it repeatedly till it becomes compact and malleable. In this state, it is the substance described in the beginning of this Section under the name of *iron*. It is considered when pure as a simple body; but it is difficult to procure it quite pure. It is almost always contaminated with some foreign body, either some of the other metals, or oxygen, carbon, or phosphorus.

When soft iron is kept red hot for some time in a bed of charcoal, it is converted into *steel*. Steel is so hard, as to be unmalleable while cold. It is brittle, resists the file, cuts glass, strikes fire with flint, and retains the magnetic virtue when impregnated with it. It is more sonorous; and its specific gravity is greater than than that of soft iron. It varies from 7.78 to 7.84.

Steel.

These different states of iron have been long known, and many attempts were made to ascertain the cause of the differences among them. At last it was recognised by Bergman and the French chemists. Soft iron is the simple metal. *Steel* is iron combined with a portion of carbon, and has been for that reason called *subcarburet of iron*. The carbon, from Vauquelin's analysis, amounts to $\frac{1}{140}$th part of the whole. *Cast iron* is iron combined with a still greater proportion of carbon. It usually contains likewise a little oxygen.

4. Iron does not combine with azote.

Alloys.

5. Iron unites with most of the metals. Gold combines readily with iron, and forms a ductile alloy of a pale yellow or white colour, according to the proportions. Platinum is found usually alloyed with iron, but it is difficult to combine the two metals artificially, on account of the high temperature necessary to fuse them. Silver and iron combine, and form a very hard alloy of a white colour. Mercury does not readily unite to iron, but an amalgam may be formed artificially. Iron may be united to copper by fusion, but not without considerable difficulty. The alloy is grey, imperfectly ductile, and very infusible. It is probable that the variety of iron called *hotshort*, because it is brittle when red hot, owes that property to the presence of a little copper with which it is alloyed.

Sect. XI. *Of Nickel.*

Nickel.

Nickel was first recognised as a peculiar metal, in consequence of the experiments of Cronstedt in 1751. It is obtained from an ore which occurs in different German mines, and called *kupfer nickel*, or false copper, because it resembles copper, though no copper can be extracted from it. It has been examined by many eminent chemists, especially by Richter, to whom we are indebted for the most exact account of its properties.

Properties.

1. Nickel has a white colour like silver; it is softer than iron; its specific gravity, when hammered, is 8.820. It is malleable both cold and hot, and may be easily hammered out into thin plates. It is powerfully attracted by the magnet, and may be converted into a magnet precisely like bars of steel. It requires for fusion a temperature at least equal to 160° of Wedgewood. It is not altered by air nor water.

Oxides.

2. When moderately heated, it tarnishes; and, if in powder, may be even converted into an oxide; but a strong heat reduces it again to the metallic state. We are at present acquainted with two oxides of nickel, the *grey* and the *black*.

The protoxide may be obtained by dissolving nickel in nitric acid, precipitating the oxide by carbonate of potash, washing it, and exposing it to a slight red heat. It is of an ash grey colour, and is composed of 78 nickel, and 22 oxygen. It is tasteless, soluble in muriatic acid, and the solution is grass green. It dissolves likewise in ammonia.

The peroxide may be formed by mixing the protoxide with water, and passing a current of chlorine gas through the liquid. A portion of the oxide dissolves, and a portion acquires a black colour. When this black oxide is dissolved in acids, an effervescence takes place, owing to the escape of a portion of its oxygen.

3. Nickel has not been combined with hydrogen. It is always united with carbon, and it unites readily with phosphorus and sulphur. Cronstedt formed sulphuret of nickel by fusion. The phosphuret may be obtained by dropping bits of phosphorus on red hot nickel.

4. Nickel does not unite with the simple incombustibles.

5. The alloys which it forms are but imperfectly known. They are mostly brittle and hard, and have been applied to no useful purpose.

Sect. XII. *Of Tin.*

Tin.

Tin was known to the ancients, and was imported from Britain at a very early period by the Phœnicians.

Properties. 1. Tin has a fine white colour, with a shade of blue. It has a slightly disagreeable taste, and emits a peculiar smell when rubbed. It is scarcely so hard as silver. Its specific gravity, when hammered, is 7.299. It is very malleable, and may be hammered out into very thin plates; but its ductility and tenacity are much inferior. A tin wire, 0.078 inch in diameter, is capable of supporting only 34.7 pounds without breaking. When tin is bent it produces a remarkable crackling noise. It melts at 442°; and, when slowly cooled, crystallizes in rhomboidal prisms.

Oxides. 2. Tin soon tarnishes when exposed to the air; but the tarnished coat is always extremely thin. It is not altered though kept under water; but, at a red heat, it decomposes water, combines with its oxygen, and disengages the hydrogen. When kept melted, it is soon covered with a greyish matter, which becomes speedily yellow. But it is very difficult to oxidize tin completely by heat and air. Tin is capable of forming two different oxides.

The *protoxide*, or grey oxide, may be formed by dissolving tin in muriatic acid by means of heat, and adding potash in excess to the solution. A white powder falls, which is gradually converted into a grey matter, having a good deal of the metallic lustre. This is the grey oxide. It is tasteless; readily soluble in acids; and greedily absorbs more oxygen. It is composed of 55 tin, and 7.5 oxygen.

The *peroxide* may be obtained by heating tin in concentrated nitric acid. A violent effervescence ensues, and the tin is converted into a white powder, which is the peroxide. It dissolves readily in potash and in muriatic acid. It is composed of 55 parts tin and 15.2 oxygen.

Chlorine readily combines with tin, and forms a curious liquid, known by the name of *fuming liquor of Libavius*.

3. Tin has not been combined with hydrogen or carbon, but it unites to phosphorus and sulphur.

Phosphuret. Phosphuret of tin may be formed by throwing bits of phosphorus on melted tin. It has the colour of silver; is soft; may be cut with a knife; and extends under the hammer, but separates into laminæ. It is composed of 85 tin and 15 phosphorus.

Sulphurets. Sulphuret of tin may be formed by fusing the two ingredients together in a crucible. It is brittle, heavier than tin, and not so fusible. It is of a bluish colour, laminated texture, and capable of crystallizing. It contains 15 parts of sulphur and 55 of tin.

When equal weights of peroxide of tin and sulphur are gradually heated in a retort, some sulphur and sulphurous acid are disengaged, and there is formed a substance called *Mosaic gold*, or *aurum musivum*. It consists of gold-coloured flakes, light, and adhering readily to the skin. Proust has endeavoured to shew, that this substance is a compound of sulphur and protoxide of gold; but his proofs are insufficient. Neither nitric nor muriatic acid acts upon it, but it dissolves in hot nitro-muriatic acid, and is gradually changed into *sulphate of tin*. It dissolves in liquid potash when assisted by heat, and deflagrates when heated with twice its weight of nitre. It consists of tin combined with twice as much sulphur as exists in sulphuret of tin.

4. Tin does not unite with the simple incombustibles, but it combines with the metals, and forms alloys, some of which are of considerable importance.

Alloys. With gold it unites easily by fusion, and was thought formerly to render the metal very brittle; but the experiments of Alchorne, Hatchett, and Bingley, have shewn that this opinion is, to a considerable degree, erroneous. Tin readily melts with platinum, and forms a brittle alloy, unless the proportion of platinum does not exceed one-ninth of the alloy. The alloy of tin and silver is very brittle and hard. Mercury dissolves tin with facility, and forms an amalgam capable of crystallizing. It is used for silvering the backs of looking glasses.

Tin unites readily with copper, and forms an alloy known by the names of *gun metal*, *bell-metal*, *bronze*, and *mirrors of telescopes*, according to the proportion of the ingredients. Tin diminishes the ductility of copper, and increases its hardness, tenacity, fusibility, and sonorousness. The specific gravity is greater than the mean, and is a maximum when the alloy is composed of 100 copper and 16 tin.

Bronze and gun-metal are composed of 100 parts of copper and from 8 to 12 of tin. Brass guns are made of it. The ancients used it for making cutting instruments. The *χαλκὸς* of the Greeks, and the *æs* of the Romans, was nothing else.

Bell-metal is usually composed of 3 parts of copper and 1 of tin. It is greyish white, very hard, sonorous, and elastic. The mirrors for telescopes consist of about 2 parts copper and 1 tin. This alloy is very hard, the colour of steel, and admits of a fine polish.

When copper is used for culinary vessels, it is covered with a thin coating of tin, and is then known by the name of *tinned copper*. The coating of tin is extremely thin, but it completely prevents the copper from injuring the articles dressed in such vessels.

Tin does not unite readily with iron; but the two metals may be combined by fusing them together in a well closed crucible. The formation of *tin-plate* shows the affinity between the two metals. This very useful compound is made by dipping clean plates of iron into melted tin.

Sect. XIII. *Of Lead.*

Lead. Lead was very well known to the ancients, but they do not always seem to distinguish it accurately from tin; though the properties of the two metals be exceedingly different.

Properties. 1. Lead has a bluish white colour, and, when newly melted, is very bright; but it soon tarnishes when exposed to the air. It is tasteless; but, when rubbed, emits a peculiar smell. It stains the fingers or paper dark blue. When taken internally, it is poisonous. It is very soft. Its specific gravity is 11.407. It is not increased by hammering. It is very malleable; but its ductility and tenacity are not great. A lead wire, 0.078 inch in diameter, is capable of supporting only 27.7 lbs. without breaking. It melts at 612°. When slowly cooled, it crystallizes in 4 sided pyramids.

Oxides.

2. Lead soon tarnishes in the open air, but the oxidizement never proceeds far. Water does not act upon it, though it greatly facilitates the action of the external air. Lead is believed at present to be capable of forming 3 different oxides.

The *yellow oxide* is the most important, as it constitutes the basis of almost all the known salts of lead. It may be obtained by dissolving lead in nitric acid, precipitating by carbonate of potash, and heating the white powder which falls almost to redness. It is yellow, tasteless, insoluble in water, but soluble in potash and in acids. It readily melts, and forms a brittle semitransparent hard glass. It is composed of 100 lead and 7.7 oxygen. It may be formed by exposing lead for a sufficient time to the action of heat and air, and is then known by the name of *massicot.*

If yellow oxide be dissolved in nitric acid, and the solution boiled over a quantity of lead filings in a phial, the liquid assumes a yellow colour, and yields yellow, brilliant crystals, in scales. These crystals, according to Proust, consist of nitric acid united to an oxide of lead, containing less oxygen than yellow oxide. But his experiments have not been verified by subsequent inquirers.

If massicot, ground to a fine powder, be exposed in a furnace to the flame of burning coals, playing upon its surface for about 48 hours, it is converted into a beautiful red powder, called *minium,* or *red lead.* This is the *deutoxide* or *red oxide* of lead. It is of an orange red colour, of the specific gravity of 8.940; insoluble in water, but soluble in potash. When heated to redness, it gives out oxygen gas, and is partly reduced, and partly melted, to a dark brown glass. It does not combine with acids. When acids dissolve it, they first reduce it to the state of yellow oxide. It is composed of 90 lead, and 10 oxygen.

If weak nitric acid be poured upon red lead, a portion is dissolved, but a portion remains in the state of a dark *brown powder.* This brown powder is the peroxide of lead. It is tasteless, light, and is not acted on by sulphuric or nitric acid. To muriatic acid it gives out oxygen, and converts it into oxymuriatic acid. It is composed of 86.5 lead, and 13.5 oxygen.

When lead is first extracted from its ore, it almost always contains a portion of silver, which is always extracted when its quantity is sufficient to repay the expence. The process is known by the name of *refining* the lead. The lead is placed in a large flat dish, called a *test,* composed of burnt bones and fern ashes, and exposed to the flame of a furnace. The lead gradually assumes a kind of vitriform state, and is either blown off or sinks into the test, while the silver remains unaltered. The lead by this process is converted into *litharge.* It consists of fine scales, partly red and partly yellow. It is yellow oxide, combined with a small portion of carbonic acid.

3. Lead has not been combined with hydrogen or carbon, but it unites to phosphorus and sulphur.

Phosphuret.

Phosphuret of lead may be formed by dropping phosphorus into melted lead. It has a silver white colour, with a shade of blue, and soon tarnishes.

Sulphuret.

Sulphuret of lead may be formed by mixing the two ingredients and melting them in a crucible. It occurs abundantly native, and is known by the name of *galena.* It is brittle, brilliant, of the colour of lead, less fusible, and usually crystallizes in cubes. Its specific gravity is about 7. It is composed of 86.5 lead and 13.5 sulphur.

There is another sulphuret of lead, which has been occasionally found native also. The colour is lighter, and it burns with a blue flame when placed upon burning coals. It contains at least 25 per cent. of sulphur.

4. Lead does not combine with the simple incombustibles. It forms alloys with the other metals, but few of them are of much importance.

Alloys.

It renders gold as brittle as glass, when the proportion of it does not exceed $\frac{1}{1920}$th of the gold. It likewise renders platinum brittle. The alloy of silver and lead is very brittle; its specific gravity is greater than the mean. Mercury readily dissolves lead, and forms an amalgam capable of crystallizing. Copper dissolves in lead at a strong red heat. The alloy is grey and brittle, and when heated gradually, the lead melts and runs off, leaving the copper nearly pure. Iron unites with lead with difficulty, and the alloy is easily decomposed. Lead and tin may be combined in any proportion. The alloy is harder, and possesses more tenacity than tin.

SECT. XIV. *Of Zinc.*

Zinc.

The ancients do not appear to have been acquainted with this metal. It has been long known in China, and is mentioned by European writers in the 13th century. The method of extracting it from its ores was unknown in Europe till near the middle of the 18th century.

Properties.

1. Zinc has a brilliant white colour, with a shade of blue, and is composed of thin plates cohering together. It has a sensible taste, and acquires, when rubbed, a slight smell. It is rather harder than silver. When hammered, its specific gravity is 7.1908. In its usual state it can scarcely be said to be malleable; but when heated a little above 212°, it becomes very malleable, and may be rolled out into thin plates, or drawn into wire. A zinc wire 0.078th inch in diameter, is capable of supporting 109.8 lbs. When heated to about 680°, it melts, and, if cooled slowly, crystallizes in quadrangular prisms.

Oxides.

2. When exposed to the air, its surface is soon tarnished, but it hardly undergoes any other change. It is said to decompose water slowly, and to separate the hydrogen. At a red heat, the decomposition goes on rapidly. When zinc is heated to redness, it takes fire, and burns with great brilliancy, being converted into a white oxide, which flies off in fine flakes like cotton. It was called *pompholyx, nihil album, lana philosophica, flowers of zinc.*

Only one oxide of zinc is known. It is the *peroxide,* or the white oxide obtained by the combustion of the metal. It is composed of 80.39 parts zinc and 19.61 oxygen. It may be obtained likewise by dissolving zinc in sulphuric acid, and precipitating by means of potash. It is very white, light, and has some resemblance to chalk. It is tasteless and insoluble in water, and is not altered by exposure to the air.

Combinations with combustibles.

3. Most of the simple combustibles combine with zinc. Hydrogen gas, procured by the action of diluted sulphuric acid on zinc, holds a little of the metal in solution, which it gradually deposites.

Carbon was considered as an occasional constituent of zinc, and supposed to occasion the appearance of the black powder which separates when zinc is dissolved in sulphuric acid. But on examining this powder, it was found a mixture of copper and lead.

Phosphuret of zinc may be formed by dropping bits of phosphorus upon melted zinc. It has a considerable resemblance to lead. It is somewhat malleable. Phosphorus combines likewise with the oxide of zinc.

Sulphuret of zinc exists native in considerable quantity, and is known by the name of *blende*. It may be formed by fusing a mixture of sulphur and oxide of zinc.

4. Zinc does not unite with the simple incombustibles, but it combines with the metals, and forms alloys, some of which are of great importance.

Alloys.

It renders gold brittle, even when added in a very minute proportion. It melts readily with platinum, and renders it brittle. Silver readily combines with it, and forms a brittle alloy. Mercury easily amalgamates in any proportion when poured upon hot zinc. The amalgam is used to increase the energy of electric machines.

Zinc combines with copper, and forms one of the most useful of all the alloys, namely *brass*. It is prepared by mixing oxide of zinc, charcoal powder, and granular copper, and heating them sufficiently in a crucible. Brass is yellow. The proportion of zinc which it contains varies somewhat. In some British manufactures it amounts to one-third, while in Germany and Sweden it is said not to exceed one-fourth or one-fifth. Brass is much more fusible than copper. It is malleable while cold, but becomes brittle when heated. It is ductile, may be drawn into fine wire, and is much tougher than copper. When zinc in the metallic state is melted with copper, the alloy is known by the name of *pinchbeck, prince's metal, Prince Rupert's metal*. The colour of pinchbeck approaches more nearly to that of gold, but it is more brittle than brass.

Zinc cannot easily be alloyed with iron. The alloy is hard and white, and somewhat ductile. Tin and zinc easily unite. The alloy is hard and ductile. Lead and zinc may be united by fusion.

Sect. XV. *Of Bismuth.*

Bismuth.

This metal was unknown to the ancients. It was well known in Germany at the beginning of the 16th century. But chemists were long in reckoning it a peculiar metal.

Properties.

1. Bismuth is of a reddish white colour, and almost destitute of taste and smell. It is composed of broad brilliant plates adhering to one another. It is harder than silver. Its specific gravity is 9.822. When hammered cautiously, its density is increased, but it breaks when struck smartly. It cannot be drawn out into wire. A rod of one-tenth inch diameter is capable of supporting about 29 lbs. It melts at 476°, and may be distilled over in close vessels. When cooled slowly, it crystallizes in parallelopipeds.

Oxides.

2. It tarnishes in the air, but is not altered when kept under water. When kept melted in an open vessel, it is gradually converted into a yellow powder. In a strong red heat it takes fire and burns, with a faint blue flame, and emits a yellow smoke. This, when collected, is a *yellow oxide*. It is composed of about 89.3 bismuth, and 10.7 oxygen. This is the only oxide of bismuth at present known. It is tasteless and insoluble in water. When heated it melts into a brown glass.

Phosphuret.

3. Bismuth has not been combined with hydrogen or carbon. It does not seem capable of combining in any notable proportion with phosphorus. But it unites very readily with sulphur by fusion. The sulphuret is bluish grey, very brittle and fusible, and crystallizes in four-sided needles. It is composed of about 85 bismuth and 15 sulphur.

Alloys.

4. Bismuth does not unite with the simple incombustibles, but it combines with the metals, and forms alloys not hitherto applied to any useful purpose. It renders gold, platinum, and silver, brittle. It amalgamates readily with mercury. When the mercury exceeds, the amalgam is fluid, and has the property of dissolving lead, and rendering it also fluid. Bismuth renders copper and iron brittle. It facilitates the fusion of tin and lead: a mixture of eight parts bismuth, five lead, and three tin, is called fusible metal, because it melts at 212°. Bismuth does not combine with zinc.

Sect. XVI. *Of Antimony.*

Antimony.

The ancients were acquainted with some of the ores of antimony, but it does not appear that they knew the metal itself. Who first extracted it from its ores is unknown. But the process is first described by Basil Valentine.

Properties.

1. Antimony is of a greyish-white colour, and has considerable brilliancy. Its texture is laminated, and exhibits plates crossing each other in every direction. It is as hard as silver. Its specific gravity is 6.712. It is very brittle, and may be easily reduced to powder in a mortar. It melts at 810°, or when just red hot; and, when cooled slowly, forms oblong crystals perpendicular to the internal surface of the vessel in which it cools.

Oxides.

2. When exposed to the air it loses its lustre, but undergoes no other change. Neither is it altered by cold water, but at a red heat it decomposes water, and combines with its oxygen, while hydrogen gas is emitted. When heated in an open vessel it gradually combines with oxygen, and evaporates in a white smoke, which, when collected, was formerly called *argentine flowers of antimony*. When suddenly heated, antimony burns, and is converted into the same white oxide. Two oxides of antimony are known.

The protoxide may be obtained thus. Dissolve antimony in muriatic acid, dilute the solution with water; a white powder falls, wash it and boil it in a solution of *carbonate of potash*. Then wash and dry it. The protoxide thus obtained is a dirty white powder. At a moderate red heat, it melts, and becomes opake, and crystallizes in needles on cooling. It is composed of 81.5 antimony, 18.5 oxygen.

The peroxide may be obtained by keeping the antimony in a red heat; for the argentine flowers are peroxide of antimony. It may be obtained also by dissolving antimony in nitric acid, or by throwing it into red hot nitre. It is white, insoluble in water, and less soluble in acids than protoxide. It is easily volatilized by heat, but requires a pretty high temperature for fusion. It is composed of 77 antimony, and 23 oxygen.

Compounds with combustibles.

3. Antimony has never been combined with hydrogen or carbon; but it unites readily to phosphorus and sulphur.

Phosphuret of antimony may be formed by dropping bits of phosphorus into melted antimony. It is white, brittle, and appears of a laminated structure.

Sulphuret of antimony exists native, and was formerly distinguished by the name of *antimony*, the pure metal being called *regulus of antimony*. It has a dark-bluish grey colour, and the metallic lustre. It is brittle, and often crystallized. It is composed of 75 antimony and 25 sulphur.

The protoxide of antimony has the property of dissolving different portions of the sulphuret by means of heat, and forming with it a vitreous substance of a reddish brown colour, and differing in transparency according to the proportion of sulphuret. It is called *glass of antimony, crocus metallorum, liver of antimony*, according to its appearance.

Alloys.

4. Antimony does not combine with the simple incombustibles. But it forms alloys with almost all the metals. It renders other metals brittle, and none of its alloys is of much consequence, except the alloy of tin and antimony, which constitutes *pewter*; and of lead and antimony, which constitutes the metal of printers types.

Sect. XVII. *Of Tellurium.*

Tellurium.

This metal has been hitherto found only in the mine of Mariahilf in Transylvania. Its peculiar nature was first suspected by Muller of Reichenstein in 1782, and fully proved by the experiments of Klaproth in 1798.

Properties

1. Its colour is bluish white, its texture laminated, and its brilliancy considerable. It is very brittle. Its specific gravity is 6.115. It melts a little above the melting point of lead, and may be easily distilled over in close vessels. When cooled slowly it crystallizes.

Oxides.

2. When exposed to the blowpipe on charcoal, it burns with a blue flame, and is converted into a white oxide, which disperses in smoke. The same oxide may be obtained by dissolving the tellurium in muriatic acid, and diluting with water. When heated, it melts into a straw-coloured mass.

3. Tellurium may be combined with sulphur by fusion. The sulphuret has a leaden grey colour and radiated texture. Mr Davy has lately discovered that tellurium combines readily with hydrogen, and forms a gas soluble in water, and possessing, like sulphureted hydrogen, the characters of a weak acid. The action of the other simple combustibles has not been tried.

4. It may be amalgamated with mercury; but we are ignorant of the metallic alloys which it is capable of forming.

Sect. XVIII. *Of Arsenic.*

Arsenic.

The ancients gave the name of *arsenic* to a compound of arsenic and sulphur. The *white oxide of arsenic*, known in commerce by the name of arsenic, must also have been known to them. But they do not seem to have been acquainted with the substance which we call arsenic in its metallic state. The discoverer of this substance is unknown. But Brandt first ascertained its properties, in 1733.

Properties.

1. Arsenic has a bluish white colour, and a good deal of brilliancy. When heated in the open air, it blackens, smokes, and emits the odour of garlic. It is the softest metal known. Its specific gravity is 8.31. It is remarkably brittle. It is very volatile, subliming without melting when heated to 356°. When slowly sublimed, it crystallizes in tetrahedrons.

Oxides.

2. It may be kept under water without alteration, but in the open air it soon falls into a black powder. We know two oxides which it is capable of forming.

The *white oxide* is obtained by exposing arsenic to a moderate heat. The metal takes fire, emits the smell of garlic, and is volatilized in a white smoke, which is the oxide in question. It is obtained in the large way during the smelting of various ores which contain arsenic. It is white, compact, and like glass. Its taste is acrid and sweet, and it is one of the most virulent poisons known. It dissolves in water, and exhibits different properties of an acid. It dissolves also in alcohol, and in oils. It crystallizes in tetrahedrons. It sublimes at the heat of 383°. Its specific gravity varies from 3.7 to 5.000 according to its state. It is composed of 75.2 arsenic, and 24.8 oxygen.

The peroxide of arsenic was discovered by Scheele. It is usually called *arsenic acid*. It may be obtained by dissolving white oxide of arsenic in nitro-muriatic acid, evaporating to dryness, and applying sufficient heat to drive off these acids. In this state it is a white mass, which readily dissolves in water. Its taste is excessively sour, and it possesses all the other properties of an acid. It is composed of 65.4 parts of arsenic and 34.6 of oxygen.

Compounds with combustibles.

3. Arsenic combines readily with the simple combustibles, carbon excepted, with which it has not hitherto been united.

When a mixture of tin and arsenic, or of zinc and arsenic, is dissolved in muriatic acid, the hydrogen which exhales holds a considerable portion of arsenic in solution, and is known by the name of *arsenical hydrogen*. This gas possesses some curious properties, which have been investigated by Trommsdorff and Stromeyer.

Phosphuret of arsenic may be formed by mixing the two constituents, and distilling them together over a moderate fire. It is black and brilliant, and ought to be kept under water.

Sulphur combines readily with arsenic by heat. Two distinct compounds of these two bodies are found native. The first, called *realgar*, is of a scarlet colour, and often crystallizes in transparent prisms. It is tasteless, and not nearly so poisonous as arsenic. It is composed of 60 arsenic and 30 sulphur. The second compound is called *orpiment*. It is of a fine yellow colour, and may be formed by pouring a solution of sulphureted hydrogen into arsenic dissolved in water. It is foliated, and much heavier than realgar. According to Thenard, it is composed of three sulphur and four arsenic.

Alloys.

3. Arsenic does not combine with the simple incombustibles, but it unites with the metals, and renders them brittle. None of its alloys have been applied to any useful purpose.

SECT. XIX. *Of Cobalt.*

Cobalt.

Cobalt occurs in different mines in Germany and England, and has been long employed to give a blue colour to glass. Its peculiar properties were first ascertained by Brandt, in 1733.

Properties.

1. Cobalt has a grey colour, with a shade of red, and is not very brilliant. It is of the hardness of silver, or a little harder. Its specific gravity is 7.7. It is brittle, and easily reduced to powder. It melts at 130° Wedgewood, and crystallizes as it congeals. It is attracted by the magnet, and may itself be converted into a magnet.

Oxides.

2. It is not altered by air nor water at the ordinary temperature of the atmosphere, but in a red heat it is gradually converted into an oxide. We are acquainted with 3 oxides of cobalt.

The protoxide is blue. It may be obtained by dissolving cobalt in nitric acid, precipitating by potash, washing and drying the powder, and exposing it to a red heat for some time. It dissolves in acids without effervescence. It is composed of 83½ cobalt and 16½ oxygen.

Moist protoxide, when exposed to the air, gradually absorbs oxygen, and assumes an olive colour. This is the deutoxide of cobalt. When digested in muriatic acid, oxymuriatic acid flies off, and a solution of protoxide is obtained.

By gradual exposure to the air, more oxygen is absorbed, and the oxide becomes black. This is the peroxide. It forms abundance of oxymuriatic acid gas when digested in muriatic acid. It is composed of 80 cobalt and 20 oxygen.

3. Cobalt does not combine with carbon or hydrogen. Sulphuret of cobalt may be formed by melting the metal with sulphuret of potash. It is yellowish white, and is composed of 71½ cobalt and 28½ sulphur.

Phosphuret of cobalt may be formed, by throwing bits of phosphorus upon red hot cobalt. It is white and brittle, and soon loses its metallic lustre.

4. Cobalt does not combine with the simple incombustibles. It unites with the different metals, and forms alloys which have been but imperfectly examined.

SECT. XX. *Of Manganese.*

Manganese.

Ores of the metal called manganese are common, in which it occurs always in the state of an oxide. Scheele, Bergman, and Gahn, are the chemists to whom we are indebted for the first investigation of its properties. Of late, a valuable set of experiments on it have been made by Dr John of Berlin.

Properties.

1. Manganese, when pure, is of a greyish white colour, similar to cast iron. Its texture is granular. It is brittle, and rather softer than cast iron, as it may be filed. Its specific gravity is 8.013.

Oxides.

2. When exposed to the air, it begins immediately to absorb oxygen, and soon falls to powder. We are acquainted with three oxides of this metal, distinguished from each other by their colours, namely, the *green*, the *brown*, and the *black*. The protoxide, or green oxide, is formed when manganese is thrown into water. The water is decomposed, and the metal assumes the form of a green powder. It is composed of

87 metal.
13 oxygen.

100

The deutoxide, or brown oxide, is formed by exposing the green oxide to the air. It absorbs an additional dose of oxygen, and assumes a brown colour. This oxide is composed of

80 metal.
20 oxygen.

100

The peroxide, or black oxide, occurs native in great abundance. It may be formed artificially, by dissolving manganese in nitric acid, and evaporating to dryness. It is composed of

71.33 metal.
28.67 oxygen.

100.00

3. Manganese does not combine with hydrogen or carbon, but it unites with phosphorus and sulphur.

Phosphuret of manganese may be formed by dropping phosphorus on red hot manganese. It is white, brittle, granular, and disposed to crystallize.

Bergman did not succeed in his attempts to combine sulphur with manganese. But he formed a sulphurated oxide, by heating 8 parts of black oxide and 3 parts of sulphur.

4. Manganese does not combine with the simple incombustibles; but it unites with the metals, and forms alloys which have been but imperfectly examined.

SECT. XXI. *Of Chromium.*

Chromium.

This metal was discovered by Vauquelin, who extracted it from the red lead ore of Siberia. Owing to the violent heat necessary to fuse it, its properties are but imperfectly known.

Properties.

1. Its colour is white, intermediate between that of tin and steel. Its specific gravity is 5.90. It is very brittle, assumes a good polish, and is magnetic,

though inferior in this respect to iron, nickel, and cobalt. Acids act upon it with great difficulty. It requires a very high temperature to melt it, so that hitherto it has only been obtained in small grains.

Oxides.

2. Chromium is not altered by exposure, but when heated in the open air, it is gradually oxidized. Three oxides of this metal are known.

The protoxide, or green oxide, may be obtained by exposing chromic acid to heat in close vessels. Oxygen is disengaged, and the green oxide remains behind.

The deutoxide is intermediate between the green oxide and chromic acid. Its colour is brown.

The peroxide, or chromic acid, is found native in *red lead ore*. It is of a red, or orange colour, soluble in water, and composed of one part chromium and two parts oxygen.

The remaining properties of chromium have not been examined.

SECT. XXII. *Of Uranium.*

Uranium.

This metal was discovered by Klaproth, and extracted by him from an ore which occurs in Saxony, and is known by the name of *pechblende*.

Properties.

1. It requires so violent a heat to melt it, that hitherto the fusion has only been imperfectly accomplished. Its colour is iron grey, it has considerable lustre, and is soft enough to yield to the file. Its specific gravity is 9.000.

Oxides.

2. It forms various oxides, which have been hitherto only examined by Bucholz.

When heated to redness, it undergoes a species of combustion, and is converted into a greyish black powder, which is the protoxide. It is composed of 95 uranium and 5 oxygen.

When uranium is dissolved in nitric acid, and precipitated by potash, it is obtained in the state of a peroxide. It is a yellow, tasteless powder, insoluble in water. It dissolves with effervescence in muriatic acid, oxymuriatic acid gas being exhaled. It is composed of 80 metal and 20 oxygen.

Besides these two oxides, Bucholz is of opinion, that there are several others intermediate between them, distinguishable by their colour. He recognised four, namely, *the violet, the greenish brown, the greyish green, and the orange.*

3. Uranium is capable of uniting with sulphur. No experiments have been made of the action of the other simple combustibles on it. Neither do we know the action of the simple incombustibles, or the alloys which it forms with other metals.

SECT. XXIII. *Of Molybdenum.*

Molybdenum.

This metal is extracted from a scarce mineral called *molybdena*, first examined by Scheele. Molybdenum was first obtained in the metallic state by Hielm.

Properties.

1. Hitherto it has only been obtained in small grains simply agglutinated. Its colour is silvery white. Its specific gravity is 8.611. It is brittle, not altered though kept under water, but the effect of air is unknown.

Oxides.

2. When heated in the open air, it gradually combines with oxygen, and is volatilized in the form of small white needles. It seems capable of forming four different oxides.

The protoxide is brown. It is obtained by exposing molybdenum in powder to a red heat.

By exposing it to a longer and more violent heat, it becomes *violet brown*. This Bucholz considers as a second oxide.

The *blue* oxide may be obtained by carrying the heat a little farther, or by triturating together one part of molybdenum and two parts of molybdic acid, boiling the mass in water, and evaporating the liquid to dryness. This oxide possesses several properties of an acid. It converts vegetable blues to red, and combines with saline bases and forms salts. It may be called *molybdous acid*. It is composed of 100 metal and 34 oxygen.

The *white* oxide, or *molybdic acid*, is obtained by roasting molybdena for some time, dissolving the grey powder in ammonia, and pouring nitric acid into the solution. The oxide precipitates in fine white scales, which, when melted and sublimed, become yellow. It converts vegetable blues to red, but does not act so powerfully as the blue oxide. It is composed of two parts metal and one part oxygen.

3. Molybdenum combines with phosphorus and sulphur, but not with carbon and hydrogen.

Molybdena.

Sulphuret of molybdenum occurs *native*, and is usually called *molybdena*. It is of a bluish grey colour, has the metallic lustre, and is composed of plates. It consists of 60 parts metal and 40 sulphur.

4. The simple incombustibles do not combine with molybdenum; but it unites with the metals, and forms alloys which hitherto have been examined only by Hielm. None of them are of much importance.

SECT. XXIV. *Of Tungsten.*

Tungsten.

Tungsten was discovered by Scheele, and reduced to the metallic state by the D'Elhuyars. It is so difficult of fusion, that hitherto it has been very seldom procured in a tolerably compact state. It is sometimes called *Scheelium*, after the discoverer.

Properties.

1. It is of a greyish white colour, and has a good deal of brilliancy. It is very hard, and seems to be brittle. Its specific gravity is 17.6. It requires a temperature at least equal to 170° Wedgewood to melt it. It is not magnetic.

Oxides.

2. When heated in an open vessel it is gradually oxidized. We are acquainted with two different oxides of this metal, the *blue* and the *yellow*.

The *protoxide*, or *blue* oxide, may be obtained by heating the yellow oxide for some hours in a covered crucible.

The *peroxide*, or *yellow* oxide, may be obtained by boiling tungsten, or its ore, in muriatic acid, decanting off the acid, and allowing it to settle. A yellow powder gradually precipitates. This yellow powder is to be dissolved in ammonia, the solution evaporated to dryness, and the residue kept for some time in a red heat. This yellow oxide is composed of 80 parts metal and 20 oxygen. It combines with bases, forms salts, and therefore has been considered as an acid. Its specific gravity is 6.12.

3. Tungsten combines with sulphur and phosphorus, but not with hydrogen or carbon.

4. The simple incombustibles do not unite with it, but it combines with the metals and forms alloys, hitherto examined only by the Elhuyarts.

Sect. XXV. *Of Titanium.*

Titanium.

This metal was discovered by Mr Gregor; but it received its name from Klaproth, who discovered it without any knowledge of the labours of Gregor.

1. It is so refractory that most persons have failed in their attempts to reduce it. Lampadius is said to have succeeded. Its colour is that of copper, and it has considerable lustre. It is brittle, but elastic.

Oxides.

2. It is easily oxidized by exposure to heat and air. We know three oxides of titanium, the *blue*, the *red*, and the *white*.

The protoxide, which is *blue*, or *purple*, is formed by exposing titanium hot to the open air.

The red oxide is found native. It is often crystallized in four-sided prisms. Its specific gravity is 4.2, and it is hard enough to scratch glass. By a very violent heat it seems to be partially oxidized. It appears to be composed of 100 metal and 33 oxygen.

The *peroxide*, or white oxide, may be obtained by fusing the red oxide in a crucible with four times its weight of potash, and dissolving the whole in water. A white powder gradually precipitates, which is the oxide in question. It is composed of about two parts metal and one oxygen.

3. Titanium has been combined with none of the simple combustibles except phosphorus. The phosphuret is of a white colour, brittle, and granular, and does not melt before the blowpipe.

4. Hitherto titanium has been alloyed with none of the metals, except iron.

Sect. XXVI. *Of Columbium.*

Columbium.

This metal was discovered by Mr Hatchett during the analysis of an ore from America, deposited in the British museum. He obtained from the mineral a white powder, which possessed acid properties peculiar to itself. He shewed that this powder was a metallic oxide; but all attempts to reduce it to the metallic state were unsuccessful. We are at present ignorant of the properties of this metal.

Ekeberg, a Swedish chemist, announced, some years ago, that he had discovered a peculiar metal, to which he gave the name of tantalum. Dr Wollaston has lately proved, that this new metal is the same with Mr Hatchett's columbium.

Sect. XXVII. *Of Cerium.*

Cerium.

This metal was discovered by Hisinger and Berzelius in a mineral found in a Swedish copper mine, and at first confounded with tungsten. To procure the oxide of cerium is easy, but all attempts to reduce that oxide to the metallic state have failed. The metal appears to be volatile, and is dissipated by a violent heat, while a moderate heat is not sufficient to reduce it.

1. Cerium appears to be white and brittle; but its other properties are unknown.

2. It forms, at least, two oxides, the *white* and the *red*; and, according to the Swedish chemists, there are two oxides intermediate between these, the *yellow* and the *brown*.

3. We are unacquainted with the effect of the simple combustibles and incombustibles on cerium. It has been alloyed with iron, but with no other metal.

Sect. XXVIII. *General Remarks.*

General remarks.

The following Table exhibits a synoptical view of some of the principal properties of the metals.

Properties of the metals.

Metals.	*Colour.*	*Hardness.*	*Specific Gravity.*	*Melting Point.*		*Tenacity.*
				Fahrenheit.	*Wedgewood.*	
Gold	Yellow	6.5	19.361		32	150.07
Platinum	White	8	23.000		170	274.31
Silver	White	7	10.510		22	187.13
Mercury	White	0	13.568	—39		
Palladium	White	9	11.871		160+	
Rhodium	White		11.+		160 +	
Iridium	White				160+	
Osmium	Blue				160 +	
Copper	Red	7.5	8.895		27	302.26
Iron	Grey	9	7.8		158	549.25
Nickel	White	8.5	8.820		160+	
Tin	White	6	7.299	442		34.70
Lead	Blue	5.5	11.352	612		27.70
Zinc	White	6.5	6.861	680		109.80
Bismuth	Reddish-white	7.	9.822	476		20.10
Antimony	White	6.5	6.712	810		7.
Tellurium	White		6.115	612+		
Arsenic	White	5	8.310	400+		
Cobalt	Grey	6	7.7		130	
Manganese	Grey	9	8.013		160	
Chromium	White		5.90		170+	
Uranium	Iron-grey		9.000		170+	
Molybdenum	White		8.611		170 +	
Tungsten	White	9 +	17.600		170 +	
Titanium	Red				170+	
Columbium					170 +	
Cerium	White				170 +	

Elements of Chemistry.

2. All the metals are capable of combining with oxygen. The knowledge of the number of oxides, and of the proportion of oxygen which they contain, is of great importance. The following Table exhibits a list of these oxides, as far as known, of their colours, and of the quantity of oxygen in each, combined with 100 parts of metal

Table of the oxides.

Metals.	*Oxides.*	*Colours.*	*Oxygen.*
Gold	1 2	Purple Yellow	 32
Platinum	1 2	Green Brown	7.5 15
Silver	1 2	——— Olive	 7.925
Mercury	1 2	Black Red	5 10
Palladium	1 2	Blue Yellow	
Rhodium	P[*]	Yellow	
Iridium	1 2	Blue ? Red ?	
Osmium	P	Transpar.	
Copper	1 2	Red Black	12.5 25
Iron	1 2 3	——— Black Red	 29.5 44.25
Nickel	1 2	Grey Black	28
Tin	1 2 3	——— Grey White	— 25 38.8
Lead	1 2 3	Yellow Red Brown	7.7 11.1 15.4
Zinc	1	White	24.4
Bismuth	P	Yellow	12
Antimony	1 2	White White	22.7 30
Tellurium	P	White	
Arsenic	1 2	White Acid	33 53
Cobalt	1 2 3	Blue Green Black	19.7 25
Manganese	1 2 3	Green Brown Black	15 25 40.
Chromium	1 2 3	Green Brown Red	 200
Uranium	1 2	Black Yellow	5.17 28
Molybdenum	1 2 3 4	Brown Violet Blue White	 34 50
Tungsten	1 2	Black Yellow	15 25
Titanium	1 2 3	Blue Red White	16 33 49
Columbium	P	White	
Cerium	1 2	White Red	

3. Of the simple combustibles, *carbon* has been only united hitherto to two metals, namely *iron* and *nickel:* hydrogen gas dissolves arsenic, zinc, and iron, seemingly in the metallic state: phosphorus combines with most of the metals hitherto tried; but these compounds have been applied to no useful purpose: sulphur likewise combines with most metals; the sulphurets are often found native; some of them are prepared artificially, as paints: we do not knowthe action of boracium on the metals.

4. The action of the simple incombustibles on metals is not striking.

5. The combinations of the metals with each other, called *alloys*, are some of them, as those of zinc and tin, of great importance. The greater number of them have only been very superficially examined.

DIVISION II.

Of Unconfinable Bodies.

Unconfinable bodies.

The unconfinable bodies cannot be examined directly; because we have no method of retaining them till we ascertain their properties. We can only draw inferences respecting them, by seeing the changes produced upon those bodies into which they enter, or from which they separate. They are four in number, namely, *light*, *heat*, *electricity*, and *magnetism*. But the examination of the two last is not considered as the province of chemistry. The two first will occupy our attention in the following Chapters.

Chap. I.

Of Light.

Light.

Every person is acquainted with the light of the sun, and of burning bodies, and that it is by means of light that bodies are rendered visible.

Huygens considered light as a subtile fluid filling space, and rendering bodies visible by the undulations into which it is thrown. While Newton, and almost all other philosophers, consider it as a subtile substance, constantly separating from luminous bodies, moving in straight lines, and rendering bodies visible by entering the eye.

Motion of light.

Light takes about 8 minutes in moving across half the earth's orbit, which is a space exceeding 94 millions of miles; of course its velocity is not much less than 200,000 miles in a second. From this velocity, joined to the imperceptible effect produced by the impulse of the particles of light on other bodies, it is obvious that its particles are inconceivably minute. Hence the reason that they produce no perceptible effect upon the most delicate balance.

Refraction.

While a ray of light moves in the same medium, or when it passes perpendicularly from one medium to another, it does not change its direction. But when it passes obliquely from one medium to another, it changes its direction, and is then said to be *refracted.* When it passes from a rarer to a denser medium, it is refracted *towards* the perpendicular; when from a denser to a rarer, it is refracted *from* the perpendicular. In the same medium, the sines of the angles of incidence and refraction have a constant ratio.

Reflection.

When a ray of light strikes obliquely against a plane surface, even though transparent, instead of passing through, it is bent back in a contrary direction. Just as would happen if an elastic ball were made to strike obliquely against the ground. The ray is then said to be *reflected.* The angle of reflection is always equal to the angle of incidence.

When a ray of light passes within a certain distance of another body, it is bent *towards* it; at a different distance it is bent *from* it. In the first case, the ray is said to be *inflected*, in the second to be *deflected*.

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[*] The letter P in the second column signifies *Peroxide.*

Light composed of seven rays.

When a ray of light is made to pass through a triangular glass prism, and received upon a sheet of paper, the image or *spectrum*, as it is called, instead of being round, is oblong. This spectrum exhibits seven different colours, in the following order, beginning with the lowest; *red, orange, yellow, green, blue, indigo, violet*. In this case the refraction of the ray is increased by the figure of the prism; and if it be heterogeneous, and consist of rays differing in refrangibility, they will separate from each other, the most refrangible going to the top of the spectrum, the least refrangible to the bottom, and the others in their order. This is the case. Light consists of seven different rays, distinguished by seven different colours. The *red* is the *least* refrangible, and the *violet* the *most*. The refrangibility of the rest is in the order of their names.

The rays of light differ in their power of illuminating objects. The lightest green or deepest yellow gives the most light, and the light diminishes as we approach either extremity of the spectrum. The violet has the least illuminating power.

Exists in bodies.

Light is capable of entering into bodies and remaining in them, and of afterwards being extricated by various means. Such bodies are said to *phosphoresce*. Almost all bodies possess this property to a certain extent. If they be exposed to the sun, and suddenly carried to the dark, they are luminous for some time, but in general for a very short period. Some bodies seem to contain light as a constituent, from which it may be extricated by various means. Thus fluor spar, and various other minerals, become luminous when heated. Herring, other fish, meat, and wood, often become luminous just before they begin to putrefy, and often continue luminous for a considerable time.

Produces changes on bodies.

Light produces considerable changes upon certain bodies. The *green colour* of plants is owing to it; for when they vegetate in the dark, they are white. Nitric acid is decomposed by exposure to the light, and oxygen gas emitted. The oxide of silver, and perhaps also of gold, is reduced by exposure to light. Till lately, it was supposed that these changes were produced by the colorific rays of light. But it has been recently ascertained, that muriate of silver is blackened most rapidly when placed beyond the violet ray, and entirely out of the prismatic spectrum. Hence it follows, that the change is produced, not merely by the colorific rays, but by rays which are incapable of rendering objects visible, or of producing any sensible heat. Thus we learn that the solar light contains at least two distinct sets of rays, one set which renders bodies visible, and another which blackens muriate of silver, and reduces metallic oxides. This second set may be called *deoxidizing* rays, till some better name is thought of. They are obviously more refrangible than the colorific rays.

Such are the properties of light. They are sufficient to induce us to believe that it is a *body*; but it possesses three peculiarities, by which it is distinguished from all the substances hitherto described. It has the power of exciting in us the sensation of vision; it always moves with a prodigious velocity, and the particles of it are never found cohering together in masses. This last property cannot well be accounted for, unless we suppose that its particles *repel* each other.

Sources.

The sources of light are, the *sun* and *stars*, *combustion*, *heat*, and *percussion*.

The light emitted by the sun is familiarly known by the name of the *light of day*. In all cases of rapid combustion light is emitted: but different substances vary very much in the quantity of light which they give out while burning. All substances, except *gases*, become luminous when heated to a certain temperature (about 700°). They are then said to be red hot. When hard substances, as two quartz stones, flint and steel, are struck against each other, luminous sparks are emitted. This is sometimes, (as in the case of flint and steel) owing to the particles given off catching fire; but in other cases, the appearance of the spark has not been accounted for.

CHAP. II.

Of Caloric.

Caloric.

THE meaning of the word *heat* is so well understood, that any attempt to define it is unnecessary. When we say that *a person feels heat*, that *a stone is hot*, the expressions are understood readily. Yet in each of these propositions, the word *heat* has a distinct meaning. In the first it signifies the *sensation of heat;* in the second, the *cause* of that sensation. to avoid the supposed ambiguity of these two meanings to one word, the term *caloric* was invented to signify the *cause of heat*. When I put my hand on a hot stone, I experience a certain sensation, which I call the *sensation of heat*; the *cause* of this sensation is *caloric*. The phenomena of heat, which are of the utmost importance in chemistry, will be treated of in the following sections.

SECT. I. *Of the Nature of Caloric.*

Nature of caloric.

Two opinions respecting the nature of caloric have divided philosophers. According to some, like *gravity*, it is merely a property of matter, while others consider it as a peculiar substance. The latter opinion was first broached by the chemists, and is at present acceded to by almost the whole body of philosophers. A recent discovery of Dr Herschel has rendered this opinion, if possible, still more plausible than before.

Rays of heat.

Dr Herschel, while employed in examining the sun by means of telescopes, thought of examining the heating power of the different rays separated by the prism. He found that the most refrangible rays have the least heating power, and that the heating power gradually increases as the refrangibility diminishes. The *violet* ray of course has the least, and the *red* ray the greatest heating power. It struck Dr Herschel as remarkable, that the illuminating power and heating power follow different laws. The illuminating power is greatest in the middle of the spectrum, but the heating power is greatest at the *red* end. This led him to suspect, that the heating power does not stop at the end of the spectrum. On trying the experiment, he found that a thermometer placed a little beyond the spectrum rose still higher than when in the red ray. This important experiment was successfully repeated by Sir Henry Englefield. Hence it follows, that there are rays emitted from the sun which produce heat, but have not the power of illuminating: consequently caloric is emitted from the sun in rays, and the rays of caloric are not the same with the rays of light.

All the illuminating rays have the power of exciting heat. It is probable that they derive this power from rays of caloric mixed with them; for the rays from the moon, though they consist of the seven prismatic rays, do not, even when concentrated, affect the most delicate thermometer.

Thus it appears that solar light is composed of three sets of rays, the *colorific*, the *calorific*, and the *de-oxidizing*.

The rays of caloric are refracted and reflected precisely as the rays of light. They obviously move with a very considerable velocity, though what that velocity is we do not at present know. It has been ascertained that caloric produces no sensible effect upon the weight of bodies; the weight remaining sensibly the same, whether a substance be hot or cold. In this respect it agrees with light. It agrees with light also in another property, its particles are never found cohering together in masses.

SECT. II. *Of the Motion of Caloric.*

Of the motion of caloric.

When heat radiates from the surfaces of bodies, it moves with great velocity; but, when it makes its way through bodies, it moves comparatively slowly. Let us consider these two kinds of motions.

1. *Escape of Heat from Surfaces.*

Escape of heat from surfaces.

When bodies, artificially heated, are exposed to the open air, they emit heat, and continue to do so till they sink to the temperature of the surrounding atmosphere. The rapidity of their cooling depends upon the nature of their surface. For the investigation of this branch of the subject, we are indebted chiefly to the sagacity of Professor Leslie. A globe of bright tin, filled with hot water, lost a certain number of degrees of heat in 156 minutes. But, when covered with a thin coat of lamp-black, it lost the same number of degrees in 81 minutes. The rate of cooling was likewise increased by covering it over with a coat of linen, and by painting it with black or white paint. This difference is only conspicuous in still air. In a strong wind it diminishes, or nearly disappears.

Leslie's experiments.

When a canister of tin, filled with hot water, is placed before a concave mirror of bright polished tin, having a delicate thermometer in the focus, the thermometer experiences a certain elevation. The *differential* thermometer, invented by Mr Leslie, answers best for these experiments. It consists of a small glass tube, bent into the shape of the letter U, and terminating at each extremity in a small hollow ball. The tube is filled with sulphuric acid, tinged red with carmine. An ivory scale is affixed to one of the legs, and the top of the liquid stands at the division of the scale marked 0. This thermometer is not affected by any change in the temperature of the room. But if one of its balls be heated, while the other is not affected, the air within it expands and pushes away the sulphuric acid, which rises in the other leg. Hence it indicates changes of heat in a particular point, as the focus of a mirror. The ball of it which is applied to the point, and undergoes the change, is called the *focal ball*.

When the experiment is made in the way above specified, the rise of the thermometer depends upon the distance of the canister from the mirror, being always the greater the nearer the canister is to the mirror. From Mr Leslie's experiments it follows, that the effect on the thermometer is very nearly inversely proportional to the distance of the canister from the reflector.

When the nature and position of the canister is the same, the rise of the thermometer is always proportional to the difference between the temperature of the hot canister and that of the surrounding air.

Heat radiates from the surfaces of hot bodies in all directions, but the radiation is most copious in the direction perpendicular to the surface of the hot body.

When different bodies are applied in succession to the surface of the canister, their power of radiation becomes evident, by the effect they produce upon the thermometer. The following Table exhibits this effect, as ascertained by the experiments of Mr Leslie.

Radiating power of bodies.

Lamp-black,	100°
Water, by estimate,	100+
Writing paper,	98
Rosin,	96
Sealing wax,	95
Crown glass,	90
China ink,	88
Ice,	85
Minium,	80
Isinglass,	80
Plumbago,	75
Tarnished lead,	45
Mercury,	20+
Clean lead,	19
Polished iron,	15
Tin-plate,	12
Gold, silver, copper,	12

Thus it appears that metals radiate heat worst, and that lamp-black, paper, and glass, are among the best radiators of it tried. The radiating power of the metals is increased by tarnishing and by scratching their surface.

The radiating powers of these bodies were ascertained by applying thin coats of them to the surface of the canisters. Now, it appears that the radiating power increases somewhat with the thickness of the coat, till that coat amounts to the $\frac{1}{1000}$ of an inch, when it remains stationary. But this does not hold with respect to metallic bodies, the thinnest coat of which produces as great an effect as the thickest.

When the focal ball of the thermometer is glass, let us suppose that it rises 100°. If we coat it with tin-foil, the rise will be reduced to 20°. Hence it follows, that those bodies that radiate heat best imbibe it best, and that those which radiate worst imbibe worst.

The contrary holds with respect to reflectors; those substances reflect *best* which radiate *worst*, and *vice versa*. The following Table exhibits the comparative goodness of different substances as reflectors, according to Mr Leslie's experiments.

Reflecting power.

Brass,	100
Silver,	90
Tin-foil,	85
Block-tin,	80
Steel,	70
Lead,	60
Tin-foil, softened by mercury,	10
Glass,	10
Ditto, coated with wax or oil,	5

When the polish of the reflector is destroyed by rubbing it with sand paper, the effect is very much diminished.

Radiation takes place only in elastic mediums. It is destroyed altogether by plunging the apparatus under water. It is nearly the same in air and in hydrogen gas, and does not seem to be affected by the nature of the elastic medium. It is diminished by rarefying the surrounding air.

Effect of a screen.

When a substance is interposed between the hot canister and the reflector by way of screen, the effect is varied by its distance from the canister, by its thickness, and by the nature of its surface. The nearer it is to the canister, the less is the radiation affected; at a certain distance all radiation is destroyed. The thinner the screen, the less of the heat is interrupted; the radiation slowly diminishes as the thickness of the screen increases. When the surface of the screen radiates heat well, the radiation is much less interrupted than if it radiate heat ill. Thus, if the screen be glass, the thermometer still rises a certain number of degrees, but if it be tin-foil the thermometer does not rise at all. From these phenomena it cannot be doubted that the screen, in all cases, intercepts the whole of the heat, that it becomes hotter itself, and then radiates heat from its surface.

Such are the phenomena of the radiation of heat as far as they have been investigated. It follows very different laws from light in its radiation. Mr Leslie has endeavoured to show, that heat is not in reality radiated, but that it is propagated with the velocity of sound by means of undulations or pulses of air. This opinion he has supported with much ingenuity. But as he has brought no other evidence for its truth, but its convenience in explaining the phenomena, and as it is at variance with the direct experiments of other philosophers, it cannot be admitted till direct evidence be brought forward in support of it.

2. *Passage of Caloric through Bodies.*

Passage of caloric through bodies.

Caloric, we have seen, is incapable of radiating through solid bodies, yet it is well known that all bodies are pervious to it. Through them, then, it must make its way in a different manner. In general it passes very slowly through them, and when it passes in this way, it is said to be conducted through them.

Bodies seem to conduct heat in consequence of their affinity for it, and of the property which they have of combining with an indefinite number of doses of it. Hence the reason of the slowness of the process. Hence also the reason why the temperature of the body through which it passes diminishes equally as we advance from the source of heat to the other extremity.

Conducting power of bodies.

Bodies vary in their power of conducting heat. The metals are the best conductors of heat of all known bodies. From the experiments of Ingenhousz it follows, that silver and gold are the best conductors among the metals. Copper and tin follow next in order, and platinum, iron, steel, and lead are nearly equal among themselves, but much inferior to the others. Stones come next after the metals, but they are greatly inferior to them. Bricks are still inferior to stones. Glass also is a bad conductor. Hence the facility with which it cracks when suddenly heated or cooled.

Dried woods are considerably inferior to glass. From the experiments of Meyer, it appears that they differ considerably among themselves. Charcoal is also a bad conductor. According to the experiments of Morveau, its conducting power is to that of fine sand as 2 to 3. Feathers, silk, wool, and hair are still worse conductors than any of the preceding substances. Hence the reason that they answer so well as articles of clothing.

It is admitted on all hands, that all solid bodies are conductors, for they allow heat to pass through them. Liquids also allow heat to pass through them. But they differ from solids in the mobility of their particles. When a particle of a liquid is heated, it becomes specifically lighter, and therefore rises. Count Rumford has endeavoured to prove, that heat passes through liquids only in consequence of the motion of their particles, and that if the particles of liquids were immoveable, heat could not pass through them at all. Hence he infers, that liquids are, in reality, non-conductors of caloric. But his experiments are not such as to warrant the conclusions he has drawn. The subject has been investigated by different chemists, with all the requisite care. It has been shown that heat can make its way downwards through liquids, in which case their particles cannot be supposed to move. Hence it follows, that they are all conductors. They are, however, very bad conductors. Water, for example, conducts heat much worse than any of the dry woods.

The gases are still worse conductors than liquids. They differ a good deal among themselves in their conducting power. Hydrogen gas appears to be the best, and carbonic acid the worst conductor. From the experiments of Leslie, it appears, that hydrogen conducts four times as well as common air. The conducting power of gases is diminished by rarefaction, by vapours of all kinds, and every thing which has a tendency to dilate air. The following Table by Mr Dalton, exhibiting the time taken by a thermometer to cool a given number of degrees in the different gases, will give the reader some idea of their relative conducting powers.

Rate of cooling in gases.

	Seconds.
Carbonic acid, ...	112
Sulphureted hydrogen,	100+
Nitrous oxide, ...	
Olefiant gas, ...	
Common air, ...	100
Oxygen, ...	
Azotic gas, ...	
Nitrous gas, ...	90
Gas from pitcoal, ...	70
Hydrogen gas, ...	40

SECT. III. *Of the equal Distribution of Temperature.*

Of the equal distribution of temperature.

When substances of different temperatures are placed in each other's neighbourhood, the hotter bodies become colder, and the colder acquire heat, and the changes continue till all the bodies acquire the same temperature. This property of caloric of distributing itself equally, has been called the *equilibrium of caloric.* It might with more propriety be called the *equal distribution of temperature.*

It had been taken for granted by Sir Isaac Newton, and was proved by the experiments of Krafft and Richmann, that when a body is suspended in a medium of a temperature different from its own, the difference between the temperature of the body and the medium diminishes in a geometrical ratio, while the time increases in an arithmetical ratio; or, which comes to the same thing, that in given small times, the heat lost is always proportional to the heat remaining in the body.

SECT. IV. *Of the Effects of Caloric.*

Of the effects of caloric.

The changes which caloric produces on bodies may be arranged under three different heads; namely, 1. Changes in bulk; 2. Changes in state; and 3. Changes in combination.

1. *Changes in Bulk.*

Changes in bulk.

Every addition or abstraction of heat produces a corresponding change in the bulk of the body affected. In general, the *addition* of heat produces *expansion*, and the *abstraction* of it produces a *diminution* of bulk. To this general law there are perhaps one or two exceptions.

Expansion

The expansion of gases by heat is greatest, that of liquids much smaller, and that of solids smallest of all. Thus, 100 cubic inches of air by being heated from 32° to 212°, expand to 137.5 inches. The same augmentation of temperature makes 100 cubic inches of iron, by the same increase of temperature, expand only to 100.1 inches.

of gases.

All gases undergo the same expansion by the same augmentation of temperature, and the same contraction by the same diminution of temperature. This change is nearly equable, though it is a little less at high temperatures than at low. From the most exact experiments hitherto made, we may conclude, that air and all gases expand about $\frac{1}{481}$ part of their bulk for every degree of heat thrown into them.

From the experiments of Gay-Lussac, it appears that the steam of water and the vapour of ether undergo the same dilation as air, when the same addition is made to their temperature. Hence it is reasonable to conclude, that all elastic fluids expand equally and uniformly by heat.

Liquids.

The expansion of liquids differs from that of elastic fluids, not only in quantity, but in the want of uniformity. Every liquid has a peculiar expansion of its own, different from that of every other liquid. The expansibility is greater when the temperature is high, than when it is low. Alcohol expands most of all the liquids hitherto tried; 100,000 parts of it at 32°, become 104,162 at 100°. Nitric acid is the next in order, then lintseed oil, then oil of turpentine, then sulphuric acid, then water, and mercury is the least expansible of all the liquids hitherto tried.

Solids.

The solids expand much less than the liquids. As far as observation has gone, their expansion is equable, or at least their deviation from it is insensible. 100,000 parts of glass at 32°, become at 100,083 at 212°. The order of the expansibility of the principal metals is as follows, beginning with the least expansible. Platinum, gold, antimony, cast-iron, steel, iron, bismuth, copper, brass, silver, brass-wire, tin, lead, zinc.

Thermometer.

The property which bodies have of expanding when heat is applied to them, has suggested an instrument for measuring the relative temperatures of bodies. This instrument is the *thermometer.* A thermometer is a hollow tube of glass hermetically sealed, and blown at one end into a hollow globe or *bulb.* The bulb and part of the tube are filled with mercury. When the bulb is plunged into a hot body, the mercury expands, and of course rises in the tube; when it is plunged into a cold body, the mercury contracts, and of consequence sinks in the tube. Thermometers are made in this way. The requisite quantity of mercury being introduced, the thermometer is plunged into melting snow, and the place where the mercury stands is marked. This is called the *freezing point.* The thermometer is then plunged into boiling water, and the point at which the mercury stands marked. This is called the *boiling water point.* The distance between these two points is divided into a number of equal parts called degrees, and these degrees are continued indefinitely above and below these two points.

The thermometer gets its name according to the number of degrees into which the space between the freezing and the boiling point is divided. There are four thermometers still used in Europe. In that of Reaumur, the space between the two points is divided into 80°. The freezing point is marked 0, the boiling point 80°. In the thermometer of Celsius, the same space is divided into 100°. The freezing point is marked 0, the boiling point 100°. This is the thermometer used in Sweden and in France since the revolution. In the thermometer of Fahrenheit, the space between the two points is divided into 180°. But the scale begins at the cold produced by a mixture of snow and salt, which is 32° below the freezing point. The freezing point is marked in consequence 32°, and the boiling point 212°. This is the thermometer used in Britain. It is the one always used in this article, except when some other is expressly mentioned. In the thermometer of Delisle, the space between the two points is divided into 150°, but the graduation begins at the boiling point, which is marked 0. The freezing point is marked 150.

As mercury does not expand equably, the thermometer does not give us an exact measure of the increase of heat. Mr Dalton has endeavoured to prove that mercury expands as the square of the temperature, reckoning from its freezing point. This opinion has induced him to construct a new thermometer, graduated according to that principle. If this opinion be correct, the common degrees are too large near the bottom of the scale, and too small towards the upper part of it. 122°, or half way between freezing and boiling, corresponds according to the new graduation with 110° of the old.

Exceptions to expansion:

The exceptions to expansion by heat are of two kinds. 1. Those liquids which have a maximum of density corresponding with a certain temperature, and which of consequence expand whether they be heated or cooled beyond that temperature.

2. Certain liquids which become solid by cooling, and expand during the solidification.

1. Water.

Water is the only liquid at present known belonging to the first class. Its greatest density is at the temperature of 40°, or a little below it. If it be heated above that temperature it expands, and it expands equally if it be cooled below it. A vast number of experiments have been made upon this point, and there appears no doubt of the matter of fact. Mr Dalton has lately endeavoured to show, that 36° is the degree at which the density of water is a maximum, and his observations appear satisfactory. No satisfactory explanation of the cause of this singular anomaly has yet been offered.

2. Other bodies.

The second class of bodies is numerous. Water expands with great force when it freezes, and is converted into ice. The specific gravity of ice is 0.92, that of water at 60° being 1.00. Hence, ice is lighter than even boiling hot water. It always, therefore, swims on the surface of the water. A similar expansion is observable during the crystallization of most of the salts. Among the metals there are three which expand in the act of congealing; these are *cast-iron*, *bismuth*, and *antimony*. All the rest seem to contract instead of expanding. Sulphur appears also to expand when it congeals. This expansion in these bodies must be ascribed to a new arrangement, which their integrant particles assume. It would lead one to suppose a kind of polarity in these integrant particles, otherwise it is difficult to conceive why they tend to expansion with so much force. Honey, oils, and most metals contract when they become solid. Sulphuric acid also appears to contract.

2. *Changes in the State of Bodies.*

Changes in the state of bodies.

All substances in nature, as far as we know them, occur in one or other of the three states, that of *solids*, of *liquids*, and of *elastic fluids*. In a vast number of cases, the same substance is capable of assuming each of these states in succession. Thus sulphur is usually solid, but at 218° it becomes a liquid, and at 570° it boils, and is converted into an elastic fluid. Water is a liquid, but at 32° it freezes into a solid, and at 212° it boils into an elastic fluid.

All solids (a very few excepted) may be converted into liquids, by heating them sufficiently; and almost all liquids, by cooling them sufficiently, may be converted into solids. The law then is, that solids by heat are converted into liquids and elastic fluids; while elastic fluids and liquids by cold are brought into the state of solids.

Freezing explained.

1. When solids are converted into liquids, the change in some cases takes place at once, without any perceptible interval between solidity and liquidity. In other cases, the solid passes slowly through all the intermediate degrees of softness, till at last it becomes a complete liquid. The melting of ice is an example of the first kind, that of wax and tallow of the second. This change takes place at a particular temperature, which is easily ascertained in the first class, but not so easily in the second. If the substance at the usual temperature of the atmosphere be liquid, this point is called the *freezing point*; but if it be usually solid, it is called the *melting point*.—Thus 32° is the *freezing point* of water, and 476° the *melting point* of bismuth.

Freezing of water.

Though 32° be the freezing point of water, it may be cooled down considerably below that point without freezing. In thermometer tubes, we have cooled it down to 7°, and in a wine glass to 20°. When agitated or touched with a bit of ice, it freezes very suddenly.

The freezing point of water is lowered by dissolving different salts in it. Thus water saturated with common salt freezes at 4°, with sal ammoniac at 8°, with Rochelle salt at 21°, and with nitre at 26°. When the proportion of the same salt dissolved in water is varied, it follows from the experiments of Sir Charles Blagden, that the freezing point is always proportional to the quantity of the salt.

Of acids.

The nitric and sulphuric acids vary remarkably in their freezing points, according to circumstances. When much diluted with water, the weakest part freezes, while a strong portion remains liquid. When very much diluted, the whole freezes, and the freezing point is lower according to the proportion of acid present. The strong acids themselves undergo congelation, and each has a particular strength at which its congelation is the easiest. If it be stronger or weaker, more cold is necessary to congeal it. Sulphuric acid of the specific gravity 1.780 freezes at 46°. But if it be diluted with a little water, it requires a cold of —45°; the strongest sulphuric acid freezes at 1°. The strongest nitric acid freezes at —45.5°. When considerably weaker it freezes at —2°, and when still weaker at —27.7°.

Latent heat.

We are indebted to Dr Black for the first satisfactory explanation of the change of solids into liquids by heat. According to him, solids, in order to liquify, combine with a quantity of heat which enters into them, and remains in them without increasing their temperature. Hence he called it *latent heat*. Liquids congeal by giving out this *latent heat*. This opinion is established by simple but satisfactory experiments, and he ascertained that the latent heat of water is 140°. The following Table exhibits the latent heat of some other liquids, as ascertained by the experiments of Dr Irvine :

	Latent heat.	Ditto reduced to the specific heat of water.
Sulphur . .	143.68	27.14
Spermaceti .	145	
Lead	162	5.6
Bees wax . .	175	
Zinc	493	48.3
Tin	500	33
Bismuth . .	550	23.25

Dr Black has shewn also, that the softness of such bodies as are rendered plastic by heat, depends upon their combining with a quantity of caloric.

2. Thus the conversion of solids into liquids is owing to their combining with heat. There is another change no less remarkable, to which bodies are liable when exposed to the action of heat. Almost all liquids, when exposed to a certain temperature, gradually assume the form of an elastic fluid, possessing the properties of air. These fluids retain their elastic form as long as the temperature continues, but when cooled down they lose that form, and are converted into liquids.

Evaporation.

Some liquids are gradually converted into elastic fluids at all temperatures, while others do not begin to undergo the change till heated to a certain temperature. Water and alcohol are well known examples of the first class of liquids ; sulphuric acid, and the fixed oils, of the second. Water gradually evaporates, even when in the state of ice, but sulphuric acid not till heated above 212°. The first class of liquids are said to *evaporate* spontaneously.

When other circumstances are the same, the evaporation increases with the temperature, and the elasticity of the vapour, of course, increases in the same proportion. At a certain temperature this elasticity balances the pressure of the atmosphere. When that happens, if the heat be applied below, the liquid assumes the aërial form with great rapidity. The vapour forces its way through the liquid, and a violent agitation is the consequence. The liquid is then said to *boil*. Every particular liquid has a certain temperature at which it begins to boil. Thus, ether boils at 98°, alcohol at 174°, and water at 212°.

Boiling.

The boiling point varies with the pressure of the atmosphere. It is highest when the barometer is high, and lowest when it is low. All liquids boil in a vacuum about 145° lower than under the pressure of the atmosphere. The elasticity of vapour increases with the temperature. At 32° the vapour of water is capable of supporting a column of mercury 0.2 inches high ; at 212° it supports a column of 30 inches.

Dr Black applied his theory of latent heat to the conversion of liquids into elastic fluids, and showed that it is owing to the very same cause as the conversion of solids into liquids, namely, to the combination of a certain dose of caloric with the liquid without any increase of temperature. From his experiments, compared with those of Mr Watt and Mr Lavoisier, it appears that the latent heat of steam is about 1000°.

Thus it appears that Dr Black's law is very general, and comprehends every change in the state of a body. It may be stated in its most general form as follows. *Whenever a body changes its state, it either combines with caloric, or separates from caloric.*

3. It is probable, that all elastic fluids, or gases, owe their elastic form, like steam, to the combined caloric which they contain ; and that, if they could be subjected to a sufficient degree of cold, they would lose their elasticity, and be converted into liquids or solids. This has been done successfully to some gases ; oxymuriatic acid and ammonia, for example, become liquid, when cooled down low enough. The experiment has not succeeded with other gases, even though subjected at once to cold and pressure.

3. *Changes in Composition.*

Changes in composition.

Caloric not only increases the bulk of bodies and changes their state, but its action decomposes many compounds altogether, either into their elements, or it causes these elements to combine in a different manner. Thus, ammonia, in a red heat, is resolved into hydrogen and azotic gases ; and alcohol, by the same heat, is converted into inflammable air and water.

In general, those compounds, which have been formed by combustion, resist the action of heat with considerable obstinacy. Those that contain oxygen, and which have been formed without combustion, are easily decomposed, and so are most of those that contain combustibles.

Sect. V. *Of the Quantity of Caloric in Bodies.*

Of the quantity of caloric in bodies.

This investigation naturally divides itself into two parts : 1. The *relative quantities* of heat in bodies, or the quantities in each necessary to produce a given change of temperature. This is usually termed *specific caloric*. 2. The *absolute quantity* of heat which exists in bodies.

1. *Of the Specific Caloric of Bodies.*

Specific heat explained.

If equal weights of water and spermaceti oil be mixed at different temperatures, it is natural to expect that the mixture will acquire the mean temperature. Suppose the temperature of the water 100°, and that of the oil 50°, it is reasonable to expect that the water would be cooled down 25°, and that the oil would be heated 25°, and that the temperature after mixture would be 75°. But, if we make the experiment, we find the result very different. The temperature, after mixture, instead of 75°, is 83⅓°, consequently the water has lost only 16⅔, while the oil has gained 33⅓. If we mix together equal weights of water at 50°, and spermaceti oil at 100°, the temperature, after agitation, will be only 66⅓°, so that the oil has lost 33⅓, while the water has only gained 16⅔. This experiment demonstrates that the same quantity of heat does not produce the same effect on water and spermaceti oil. The quantity which raises water 16⅔, raises the oil 33⅓, or it produces double the effect upon the oil that it does on the water. If the other substances be tried in the same manner, we shall find that they all differ from each other in the quantity of caloric necessary to heat each of them a given number of degrees, some requiring more than the same weight of water would do, and others less. Now, the quantity necessary to produce this effect is called the *specific caloric* of each. The specific caloric of water is taken as the standard and called 1, and all the others referred to it. It is obvious, from the preceding example, that the specific caloric of water is double that of spermaceti oil. If we represent the first by 1, we must, of course, represent the second by 0.5.

This investigation was begun by Dr Black, and prosecuted by Dr Irvine and Dr Crawford, who published a table of the specific heat of various bodies, and made it the foundation of his explanation of animal heat. Mr Wilcke of Sweden likewise investigated the specific heat of various bodies. Lavoisier and Laplace attempted the investigation, by ascertaining how much ice given weights of bodies, heated a certain number of degrees, was capable of melting during the cooling. The subject was afterwards prosecuted by Kirwan, Meyer, Leslie, and Dalton. The following Table exhibits the result of all the experiments hitherto published on this important subject.

Table of the specific heats of bodies.

I. *Gases.*

	Sp. Caloric.
Hydrogen	21.4000*
Oxygen	4.7490*
Common air	1.7900*
Carbonic acid	1.0454*
Azote	0.7936*

II. *Water.*

Ice	0.9000†
	0.8000(*a*)
Water	1.0000
Steam	1.5500*

III. *Saline Solutions.*

		Sp. Caloric.
Carbonate of ammonia		1.851†
		0.95 (D)
Sulphuret of ammonia (0.818)		0.994†
Sulphate of magnesia	1	0.844†
Water	2	
Common salt	1	0.832†
Water	8	
Ditto (1.197)		0.78 (D)
Nitre	1	0.8167‡
Water	8	
Nitre	1	0646†
Water	3	
Carbonate of potash (1.30)		0.75 (D)
Muriate of ammonia	1	0.798†
Water	1.5	
Tartar	1	0.765†
Water	237.3	
Sulphate of iron	1	0.734†
Water	2.5	
Sulphate of soda	1	0.728†
Water	2.9	
Alum	1	0.649†
Water	2.9	
Nitric acid	9½	0.6189‡
Lime	1	
Ditto (1.40)		0.62 (D)
Solution of brown sugar		0.086*
Ditto (1.17)		0.77 (D)

IV. *Acids and Alkalies.*

Vinegar		0.92 (D)
Nitric acid	pale	0.844†
	(1.20)	0.76 (D)
	(1.2989)	0.6613‡
		0.62 (L)
	(1.30)	0.66 (D)
	(1.355)	0.576†
	(1.36)	0.63 (D)
Muriatic acid	(1.122)	0.680†
	(1.153)	0.60 (D)
Sulphuric acid	(1.885)	0.758‡
	(1.872)	0.429†
		0.34 (L)
	(1.844)	0.35 (D)
	(1.87)	0.3345‡
		0.333 (*a*)
Do. 4, Water 5		0.6631‡
Do. 4, do. 3		0.6031‡
Do. equal bulks		0.52 (D)
Acetic acid (1.056)		0.66 (D)
Potash (1.346)		0.759†
Ammonia	(0.997)	0.708†
	(0.948)	1.03 (D)

V. *Inflammable Liquids.*

Alcohol		0.930 (*a*)
		0.6666*
		0.64 (L)
		0.602*
	(0.817)	0.70 (D)
		1.086†
	(0.848)	0.76 (D)
Sulphuric ether (0.76)		0.66 (D)
Oil of olives		0.718†
		0.50 (D)
Linseed oil		0.528†
Spermaceti oil		0.5000*
		0.52 (D)
Oil of turpentine		0.472†
		0.400 (*a*)
Spermaceti		0.399†
Ditto fluid		0.320 (*a*)

VI. *Animal Fluids.*

Arterial blood	1.0300*
Venous blood	0.8928*
Cow's milk	0.9999*
	0.98 (D)

VII. *Animal Solids.*

Ox hide, with hair	0.7870*

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* Crawford; † Kirwan; ‡ Lavoisier and Laplace; § Wilcke; ¶ Meyer; (L) Leslie; ‖ Count Rumford; (D) Dalton; (*a*) Irvine.

	Sp. Caloric.
Lungs of a sheep	0.7690 *
Lean of ox-beef	0.7400 *

VIII. *Vegetable Substances.*

Pinus sylvestris	0.65 ¶
Pinus abies	0.60 ¶
Tilea Europæa	0.62 ¶
Pinus picea	0.58 ¶
Pyrus malus	0.57 ¶
Betula alnus	0.53 ¶
Quercus robur sessilis	0.51 ¶
Fraxinus excelsior	0.51 ¶
Pyrus communis	0.50 ¶
Rice	0.5060 *
Horse beans	0.5020 *
Dust of the pine-tree	0.5000 *
Peas	0.4920 *
Fagus sylvatica	0.49 ¶
Carpinus betulus	0.48 ¶
Betula alba	0.48 ¶
Wheat	0.4770 *
Elm	0.47 ¶
Quercus robur pedunculata	0.45 ¶
Prunus domestica	0.44 ¶
Diospyrus ebenum	0.43 ¶
Barley	0.4210 *
Oats	0.4160 *
Pit-coal	0.28 (D) 0.2777 *
Charcoal	0.2631 *
Cinders	0.1923 *

IX. *Earthy Bodies, Stone-ware and Glass.*

Hydrate of lime	0.40 (D)
Chalk	0.27 (D) 0.256 *
Quick-lime	0.30 (D) 0.2229 * 0.2168 ‡
Ashes of pit-coal	0.1855 *
Ashes of elm	0.1402 *
Agate	0.195 §
Stone-ware	0.195 †
Crown-glass	0.200 (*a*)
Crystal	0.1929 ‡
Swedish glass	0.187 §
Flint-glass	0.19 (D) 0.174 †

X. *Sulphur*	0.19 (D) 0.183 †
Muriate of soda	0.23 (D)

XI. *Metals.*

	Sp. Caloric.
Platinum	0.13 (*a*)
Iron	0.143 (*a*) 0.13 (D) 0.125 † 0.1269 * 0.126 §
Brass	0.1123 * 0.116 § 0.11 (D)
Copper	0.1111 * 0.114 § 0.11 (D)
Sheet-iron	0.1099 ‡
Gun-metal	0.1100 ‖
Nickel	0.10 (D)
Zinc	0.0943 * 0.102 § 0.10 (D)
Silver	0.082 § 0.08 (D)
Tin	0.068 † 0.0704 * 0.07 (D) 0.060 §
Antimony	0.086 † 0.0645 * 0.063 § 0.06 (D)
Gold	0.050 § 0.05 (D)
Lead	0.050 † 0.0352 * 0.042 § 0.04 (D)
Bismuth	0.043 § 0.04 (D)
Mercury	0.033 † 0.0357 * 0.0290 ‡ 0.0496 (D)

XII. *Oxides.*

Oxide of iron	0.320 †
Rust of iron	0.2500 *
Ditto, nearly free from air	0.1666 *
White oxide of antimony washed	0.220 † 0.2272 *
Ditto, nearly freed from air	0.1666 *
Oxide of copper ditto	0.2272 *
Oxide of lead and tin	0.102 †
Oxide of zinc ditto	0.1369 *
Oxide of tin nearly free from air	0.0990 * 0.096 †
Yellow oxide of lead ditto	0.0680 * 0.068 †

The specific heats of the gaseous bodies in the preceding table were ascertained by Dr Crawford, by means of very delicate experiments, made with every possible precaution to insure accuracy. Yet there is little probability that they are accurate. Nor are we in possession of any means of making them more so by experiment. Mr Dalton has calculated the specific heat of the different gases from theory. The following are the numbers he obtained. The specific heat of water, as usual, being 1.

Hydrogen gas	9.382
Azotic	1.866
Oxygen	1.333
Air	1.759
Nitrous gas	0.777

Nitrous oxide	0.549
Carbonic acid	0.491
Ammonia	1.555
Carbureted hydrogen	1.333
Olefiant gas	1.555
Nitric acid	0.491
Carbonic oxide	0.777
Sulphureted hydrogen	0.583
Muriatic acid	0.424
Aqueous vapour	1.166
Ether vapour	0.848
Alcohol vapour	0.586

Dr Crawford supposed, that the specific heat of bodies is permanent while they retain their state. But Mr Dalton has lately endeavoured to prove, that it increases with the temperature of all bodies.

Dr Irvine ascertained, that the specific caloric always changes with the state of a body. When a solid becomes a liquid, or a liquid an elastic fluid, the specific caloric increases. When an elastic fluid becomes a liquid, or a liquid a solid, the specific heat diminishes.

The specific heat of bodies is increased by combining them with oxygen. Thus, the specific heat of metallic oxides is greater than that of metals, and of acids than of their bases.

2. *Of the Absolute Quantity of Caloric in Bodies.*

As the same quantity of heat produces different changes of temperature in different bodies, it is obvious, that the thermometer cannot indicate the absolute quantity of heat in bodies. Now, it becomes a question of considerable importance to inquire, if there be any method of ascertaining the absolute quantity of heat in bodies. Supposing a body deprived of all heat, and a thermometer applied to it, at what point would the thermometer stand?

Absolute heat, how ascertained.

Dr Irvine is the philosopher who first attempted to solve this problem. His reasoning was founded upon two suppositions. 1. That the specific heat was proportional to the absolute heat of bodies. 2. That the heat emitted or absorbed by a body, when it changes its state, is merely the consequence of the change which has taken place in its specific heat. Thus, when ice is converted into water, 140° of heat are absorbed; because the specific heat of water is so much greater than that of ice, that 140° are necessary to maintain the temperature. The first of these two suppositions gave him the ratio of the absolute quantity of heat in bodies, and the second, the difference between two absolute calorics. Thus, if the specific heat of water be 10, and that of ice 9, then the absolute quantity of heat in water is, to that in ice, as 10 to 9. Call the absolute heat of ice x, then that of water is $x+140$, and we have $x : x+140 :: 9 : 10$. Hence we get this equation, $10x = 9x+1260$, which gives us $x=1260$. Water at 32° of course contains 1400° of caloric. Dr Crawford, from his experiments, stated the real zero at 1500 below 0; and Mr Dalton places it at 6000 below 0.

Unfortunately, the truth of the two suppositions upon which this ingenious reasoning is founded, cannot be admitted. We have no proof that the specific heat of bodies is proportional to their absolute heat. The second supposition is at variance with the mechanical phenomena which present themselves when substances change their state, and would leave that change itself unaccounted for. It cannot, therefore, be admitted. Various other methods of ascertaining the absolute heat of bodies have been proposed; but, as they are all unsatisfactory, it is not necessary to detail them here.

SECT. VI. *Of the Sources of Caloric.*

Of the sources of caloric.

The most important sources of heat are the five following, the *sun*, *combustion*, *percussion*, *friction*, and *mixture*.

1. *The Sun.*

The sun.

The sun is an immense globe, the diameter of which is 888,246 miles. It was long supposed to be in a state of violent combustion. But the curious observations of Dr Herschel render it probable that this notion is erroneous. From them it appears, that the sun is an opaque globe, surrounded by an atmosphere of great density and extent. In this atmosphere, there float two regions of clouds. The lowermost of the two is opake, and similar to the clouds which form in our own atmosphere; but the higher region of clouds is luminous, and emits the immense quantity of light to which the splendour of the sun is owing.

Solar rays.

The sun emits three kinds of rays; the *calorific*, *colorific*, and *deoxidizing*. The first occasions *heat*, the second *colour*, and the third separates *oxygen* from various bodies.

When the solar rays strike transparent bodies, they produce very little effect; but opake bodies are heated by them. They pass through transparent bodies; but are retained, at least in part, by opake bodies. The deeper the colour of the opake body, the greater is the heat produced. Black bodies are most heated, and white least, and the others in proportion to the intensity of the colour. The temperature produced in bodies by the direct action of the sun's rays, seldom exceeds 120°. But when the heat is prevented from escaping, as, by enclosing a thermometer within a glass vessel whose bottom is cork, the temperature sometimes rises nearly to 240°. When the sun's rays are accumulated by means of burning glasses, the most intense heat is produced that it is possible to raise by any known method.

2. *Combustion.*

Combustion.

Few phenomena are more wonderful or interesting than *combustion*. When a stone or a brick is heated it undergoes no change, and, when left to itself, it soon cools again, and becomes as at first. But, when combustible bodies are heated to a certain degree in the open air, they suddenly become much hotter of themselves, continue for a certain time intensely hot, and send out a copious stream of light and heat. When this ceases, the combustible has undergone a most complete change, being converted into a substance possessed of very different properties, and no longer capable of combustion.

The first ingenious attempt to explain combustion was by Dr Hooke. According to him, there is an ingredient in air capable of dissolving combustibles when their temperature is sufficiently raised. The solution takes place with such rapidity, that it occasions light and heat, which, in his opinion, were mere motions. The quantity of this solvent in air is not great. Hence the reason why so great a proportion of air is necessary to support combustion. This hypothesis was embraced by Mayow, but without making any great addition either to its evidence or probability.

Hypothesis of Stahl.

Beccher and Stahl soon after advanced another, which was much more universally embraced. According to them, all combustible substances contain in them a certain body called *phlogiston*, to which they owe their combustibility. This substance is the same in all combustible bodies. They owe their diversity to other ingredients combined with the phlogiston. During the combustion, the phlogiston separates, and the incombustible ingredients remain behind. The light and the heat are occasioned by the violent motion into which the phlogiston is thrown during its emission.

Light being considered as a body, occasioned a change in the Stahlian theory. Phlogiston was considered as nothing else than light fixed in bodies. When heat, in consequence chiefly of the discoveries of Dr Black, came to be considered as a body, the opinion respecting phlogiston got a new modification. It was considered as a subtile fluid, the same with the *ether* of Hooke and Newton, which occasioned gravity, and gave the bodies, called *heat* and *light*, the peculiar motions which produce in us the sensations of heat and light.

Of Priestley.

Dr Priestley first attempted to account for the necessity of air for combustion. Air, according to him, has an affinity for phlogiston; it draws it out of the combustible body, and combines with it. But if so, whence come the heat and the light, which make their appearance in all cases of combustion? According to Dr Crawford, they existed in the air, and were displaced by the phlogiston when it united with that fluid.

These modifications of the Stahlian theory were evidently improvements. But they left the nature of phlogiston altogether out of view. Kirwan first attempted to ascertain what this substance was, and to prove it the same with what is now called *hydrogen gas*. This opinion he supported in an ingenious Essay on *Phlogiston*; and it was embraced by many of the most respectable chemists in Europe.

Of Lavoisier.

Meanwhile, Mr Lavoisier had been investigating the subject with the minutest attention, and, after a very long, elaborate, and ingenious examination, had satisfied himself, that, in every case of combustion, oxygen unites with the burning body. For a long time nobody would accede to his opinion; but at last, in 1785, Berthollet and Fourcroy joined him, and soon after Guyton-Morveau came over to his sentiments. They wrote a refutation of Mr Kirwan's essay, which was so satisfactory, that Mr Kirwan himself came over to their opinion. And after a short, but pretty violent controversy, the Lavoisierian theory of combustion was universally adopted. According to this theory, combustion consists of two processes, a *combination* and a *decomposition*. The oxygen of the air *combines* with the combustible, and gives out the *heat* and *light* with which it was previously *united*.

The following observations may, perhaps, contribute somewhat to elucidate what is still obscure in this curious process.

All bodies, as far as combustion is concerned, may be divided into *supporters*, *combustibles*, and *incombustibles*. By supporters, are meant certain bodies, not indeed capable of burning, but combustion cannot go on without their presence. *Air*, for example, is a supporter. *Combustibles* and *incombustibles* require no explanation.

List of supporters.

Oxygen and chlorine are the only simple supporters known. When they combine with an incombustible, they form a compound supporter. The following are all the supporters at present known:

1. Oxygen.
2. Chlorine.
3. Air.
4. Nitrous oxide.
5. Nitrous gas.
6. Nitric acid.
7. Euchloric gas.

The combustibles are either the simple substances which have been already described, or combinations of these with each other, or with oxygen without combustion; in which last case, they may be called combustible oxides.

Products.

During combustion, the oxygen or chlorine of the supporter always combines with the combustible, and forms with it a new substance, which may be called a *product* of combustion. Now every product is either, 1. Water; 2. An acid; or, 3. A metallic oxide.

Partial supporters.

Some products are capable of combining with an additional dose of oxygen. But this combination is never attended with combustion, and the product, in consequence, is converted into a supporter. Such compounds may be called *partial supporters*, as a part only of the oxygen which they contain is capable of supporting combustion.

Since oxygen is capable of supporting combustion only in the supporters and partial supporters, it is clear that it is in a different state in these bodies from what it is in products. It is probable that, in supporters, it contains combined with it a considerable quantity of heat, which is wanting in products.

Combustion explained.

It is probable, that combustible bodies contain light as a constituent. For the quantity of light emitted during combustion depends upon the combustible; while the heat seems, in some measure at least, to depend upon the oxygen. If these two suppositions be admitted, the phenomena of combustion admit of an easy explanation. The base of the oxygen and of the combustible combine together, and form the product; while the heat of the one and the light of the other in like manner unite, and fly off in the form of fire.

3. *Percussion.*

Percussion.

It is well known, that heat is produced by the percussion of hard bodies against each other. Iron may be heated red hot by striking it with a hammer, and the sparks emitted by flint and steel are well known.

Percussion occasions condensation.

This evolution of heat appears to be the consequence of the permanent or temporary condensation of the bodies struck. Iron and most metals become specifically heavier when hammered. Now condensation always evolves heat. When air is condensed, it gives out a considerable quantity of heat, sufficient to set fire to tinder. When muriatic acid gas is passed through water, it is condensed, and the water becomes hot. On the other hand, when air is rarefied, it becomes suddenly much colder.

It is not difficult to see why condensation evolves heat. The particles being forced nearer each other, the repulsive force of the heat is increased, and a portion in consequence is driven off. The specific caloric of bodies is diminished by condensation. Now the specific caloric can scarcely be conceived to diminish without the body giving out heat.

A part of the heat which follows percussion, is often owing to another cause. By the percussion, the heat of the body is raised so high, that combustion commences, and this occasions a still farther increase of the heat. It is in this way that sparks are produced when flint and steel are struck. The sparks are small pieces of the steel which have taken fire and melted during their passage through the air.

4. *Friction.*

Friction.

Heat is not only evolved by percussion, but also by friction. And not only by the friction of hard bodies, but even of soft bodies, as when the hand is rubbed against the sleeve of the coat. No heat has ever been observed from the friction of liquids.

The heat evolved by friction seems to be owing to the same cause as that by percussion; namely, a condensation of the substances rubbed. This condensation is, in some cases, permanent; but when the bodies rubbed are soft, it can only be momentary.

The heat evolved by friction is sometimes very considerable. Thus Count Rumford boiled water by the heat evolved by rubbing a steel borer against a cylinder of gun-metal. Probably in this case the density of the metal was a little increased. A very small increase would account for the whole heat evolved.

5. *Mixture.*

Mixture.

In a great number of cases, a change of temperature takes place when bodies combine chemically with each other. Sometimes the compound becomes colder than before, and sometimes hotter.

Change of temperature by mixture owing to water.

When Glauber's salt in crystals pounded is dissolved in water, a considerable degree of cold is produced; and the cold is still more intense, if the salt be dissolved in muriatic acid. If muriate of lime, in powder, and dry snow be mixed together, so great a degree of cold is produced, that mercury may be frozen if it be surrounded by such a mixture. Potash and snow produce an equally great cold. When nitric acid or sulphuric acid is poured upon snow, the snow dissolves, and an intense cold is produced.

On the other hand, when sulphuric acid and water are mixed, so great a heat is evolved, that the liquid is considerably hotter than boiling water. Heat also is produced, when nitric acid and water, or water and alcohol, are mixed together. Heat also is produced if Glauber salt, in a state of efflorescence, is dissolved in water. An intense heat is produced by dissolving quick-lime in sulphuric acid.

In most of these cases of change of temperature, water is either one of the substances combined, or it forms an essential constituent of one of them. The heat or the cold produced, depends often on this constituent. Thus Glauber's salt, containing its water of crystallization, produces cold when dissolved; while the same salt, deprived of its water of crystallization, produces heat.

If the new compound be more fluid than the two constituents of it, the temperature sinks; if it be less fluid, the temperature rises. Thus, when snow and common salt are mixed, they gradually melt and assume the form of a liquid, and the temperature sinks to zero. Solid water cannot become liquid, without combining with a quantity of heat; and the same rule applies to all solid bodies which become liquid. Hence the cold evolved in these cases. The water of crystallization in Glauber's salt is solid: it becomes liquid when the salt is dissolved. Hence the cold produced. When the same salt, free from its water of crystallization, is thrown into water, it first combines with a portion of the water, and renders it solid. Hence the heat evolved. Dr Black's doctrine of latent heat affords a satisfactory explanation of these phenomena.

Or to the specific heat changing.

When the density of two liquids united is greater than the mean, heat is evolved, because the specific caloric of the new compound is less than that of the constituents. This was first observed by Dr Irvine, and it accounts for the heat evolved when water is mixed with sulphuric acid, nitric acid, or alcohol.

Thus it appears, that the changes of temperature produced by mixture, are either occasioned by the change of state which the water undergoes, or by a diminution of specific caloric, in consequence of the new combination.

BOOK II.

OF COMPOUND BODIES.

Of compound bodies.

Compound bodies are substances composed of two or more simple substances united together. They amount to several thousands; but the present state of the science does not permit us to give an account of them all under their proper heads.

Two classes of compounds.

Compound bodies are of two kinds. Some are formed by the combination of two or more simple substances with each other; while others are formed by the union of two or more compound bodies with each other. To the first class belong *phosphoric acid*, composed of phosphorus and oxygen; and *ammonia*, composed of azote and hydrogen. To the second class belongs *phosphate of ammonia*, composed of phosphoric acid and ammonia. The first of these sets we shall call *primary compounds*; to the second we shall give the name of *secondary compounds*.

DIVISION I.

Of Primary Compounds.

Of primary compounds.

The primary compounds, such of them at least as we are sufficiently well acquainted with to introduce here, may be arranged under the following heads:

1. Alkalies.
2. Earths.
3. Oxides.
4. Acids.
5. Compounds of chlorine.
6. Compound combustibles.

These shall be the subject of the six following Chapters.

Chap. I.

Of Alkalies.

The term *alkali* was introduced into chemistry, after having been applied to a plant that still retains the name of *kali.* When this plant is burnt, the ashes washed in water, and the water evaporated to dryness, a white substance remains, called *alkali.* Alkali may be obtained from many other bodies besides this plant. Chemists gradually discovered that different substances had been confounded together under the name of alkali. The word, in consequence, became general, and is now applied to all substances having the following properties.

Alkali explained.

1. A caustic taste.
2. Volatilized by heat.
3. Capable of combining with acids, and of destroying their acidity.
4. Soluble in water, even when combined with carbonic acid.
5. Capable of converting vegetable blues to green.

The alkalies at present known are three in number; 1. Ammonia; 2. Potash; 3. Soda. The first is called *volatile alkali;* the two last *fixed alkalies.*

Sect. I. *Of Ammonia.*

Ammonia, how obtained.

Put into a retort a mixture of three parts quicklime, and one part sal-ammoniac; plunge the beak of the retort into a trough filled with mercury. Apply heat. A gas comes over, which may be received in glass jars filled with mercury. This gas is *ammonia.*

Its properties.

This gas possesses the mechanical properties of common air. Its taste is acrid and pungent, and it has a strong smell, not unpleasant when diluted. Animals cannot breathe it, and combustibles do not burn in it. Its specific gravity is 0.600, that of air being 1.000. At the temperature of 60°, 100 cubic inches of it weigh 18.16 grains. When exposed to a cold of —45°, it is condensed into a liquid. When passed through a red-hot tube, it is decomposed and converted into hydrogen and azotic gases.

Water absorbs it with great rapidity. This liquid absorbs 780 times its bulk of this gas; and six parts of water, by this absorption, increase in bulk to 10 parts. The specific gravity of this solution is 0.900. It is in this state that ammonia is commonly used. It was known to the alchymists, and called *hartshorn, spirit of urine,* and *spirit of sal ammoniac.*

Composition.

Ammoniacal gas is not altered by light, but when electric sparks are made to pass through it, its bulk is nearly doubled, and it is converted into hydrogen and azotic gases. Hence it follows, that it is composed of hydrogen and azote. The most exact experiments make the proportion of the constituents, three parts, in bulk, of hydrogen gas, and one part of azote; or in weight,

81.5 azote,
18.5 hydrogen.
———
100.0

Action of oxygen.

When mixed with oxygen gas, it detonates by electricity, and is decomposed, as Dr Henry has ascertained. To analyse ammonia by means of oxygen, it ought to be first mixed with half its bulk of oxygen gas. An electric spark occasions a combustion; but the whole of the hydrogen is not consumed. By adding another quantity of oxygen gas, a new combustion may be produced. Double the oxygen gas consumed indicates the bulk of hydrogen, and the azote remaining in the residuary gas, its bulk may be estimated.

Chlorine.

When mixed with chlorine, it burns with considerable splendour; and a quantity of sal-ammoniac is formed at the same time.

Sulphur.

Sulphur is the only one of the simple combustibles that combines with ammonia. The combination may be produced by mixing it with sulphur in the state of vapour, or better by distilling a mixture of equal weights of sal-ammoniac, sulphur, and quick-lime diluted with a little water. A yellow liquid comes over, which consists of water, holding in solution ammonia and sulphur. It contains an excess of ammonia.

When ammonia comes in contact with phosphorus at a red heat, it is decomposed, and phosphureted hydrogen gas formed. When ammoniacal gas is made to pass through red-hot charcoal, a substance is formed called *prussic acid.*

Ammonia is not acted on by azote.

Action of metals.

Ammonia is capable of oxidizing some of the metals, and of dissolving the oxides formed. Liquid ammonia dissolves the oxides of silver, copper, iron, tin, nickel, zinc, bismuth, and cobalt. When digested upon the oxides of mercury, lead, or manganese, it is decomposed, water formed, and azotic gas emitted. It combines readily with the peroxides of gold and silver; and forms two remarkable compounds, known by the names of *fulminating gold* and *silver.*

Fulminating gold.

Fulminating gold may be obtained by dissolving gold in aqua regia, and precipitating it by ammonia. A yellow precipitate falls, which is to be washed and dried. It is fulminating gold. It is composed of five parts yellow oxide of gold, and one part of ammonia. It fulminates violently, when heated to the temperature of about 300° or 400°; also when struck violently with a hammer, or when triturated in a mortar. Water is formed, and azotic gas emitted.

Fulminating silver.

Fulminating silver was discovered by Berthollet. It may be prepared by dissolving silver in nitric acid, precipitating by lime-water, drying the precipitate in a filter, and then keeping it for twelve hours in liquid ammonia. Its tendency to explode is so strong, that it is dangerous to prepare it except in small quantities.

Ammonium.

If a globule of mercury be put into a hollow in a moistened piece of sal ammoniac, and exposed to the energy of a powerful galvanic battery, it increases in bulk, and acquires the consistency of butter. Its specific gravity is reduced to 3. The mercury has obviously amalgamated with some metallic body. If this amalgam be thrown into water, the mercury resumes its original state, a little hydrogen gas is exhaled, and the water is impregnated with a weak solution of ammonia. Hence it would appear, that the amalgamating metal is the basis of ammonia; that it decomposes water, emits the hydrogen, and retains the oxygen; and that, by this combination, it is converted into ammonia. This unknown metallic basis of ammonia has been called *ammonium*.

Sect. II. *Of Potash.*

Potash, how procured.

Potash, called also *vegetable alkali*, is obtained from the ashes of trees, and of vegetables that grow at a distance from the sea-shore. These ashes are lixiviated with water; the water evaporated to dryness; the residual salt mixed with twice its weight of quicklime, and a sufficient quantity of water to make the whole into a thin paste. The water is drawn off in 24 hours, boiled to dryness in a clean iron pot, and then mixed with a quantity of alcohol, equal in weight to half the original salt. The alcoholic solution, after standing some days in well-closed phials, is decanted off, and the alcohol distilled away in a silver still. The substance which remains behind is pure potash.

Its properties

Potash is a brittle substance, of a white colour, and a smell like that which is perceived during the slacking of quick-lime. Its taste is extremely acrid, and it is very corrosive, destroying the texture of most animal and vegetable bodies to which it is applied. Its specific gravity is 1.7085.

When heated, it melts. At a red heat, it evaporates in a white acrid smoke.

It contains about one-fourth of its weight of water, even after being exposed to a red heat. When exposed to the air, it speedily absorbs moisture, and runs into a liquid. At the same time, it combines with carbonic acid, for which it has a strong affinity.

Water dissolves twice its weight of potash. The solution is limpid and colourless, and almost of the consistency of an oil. It is in this state that potash is commonly used by chemists. When evaporated to the proper consistency, the potash crystallizes.

Combination with sulphur.

2. Potash does not combine with any of the simple combustibles, except sulphur. The combination takes place by simple trituration of the two substances in a mortar, or by fusing them in a crucible. This compound is called *sulphuret of potash*. It was formerly distinguished by the name of *hepar sulphuris*, or *liver of sulphur*. Its colour is brown; it is hard, brittle, and has a glassy fracture. Its taste is acrid and bitter, and it leaves a brown stain on the skin. It converts vegetable blues to green, and soon destroys them. When exposed to the air, it acquires a green colour, and emits the smell of sulphureted hydrogen. In this state it is a triple compound, being composed of sulphur, potash, and sulphureted hydrogen. The last ingredient is formed by the decomposition of the water absorbed from the atmosphere. It dissolves in water, and forms a greenish yellow solution. In this state it is called *hydrogureted sulphuret of potash*.

When liquid potash and phosphorus are heated in a retort, water is decomposed, and *phosphureted hydrogen* gas is formed and comes over. This gas possesses the curious property of taking fire when it comes in contact with the air.

3. Potash does not unite with azote.

4. Several of the metals, when kept in liquid potash, are oxidized, water being decomposed. This is the case with iron, zinc, and molybdenum; and probably also with tin and manganese.

Potash dissolves the oxides of lead, tin, nickel, arsenic, cobalt, manganese, zinc, antimony, tellurium, tungsten, molybdenum.

Potassium.

Mr Davy has lately succeeded in decomposing potash, and in showing that it is a compound of oxygen and a peculiar metal, to which he has given the name of *potassium*. The decomposition was accomplished by exposing potash to the action of the galvanic battery. The metallic base separated at the negative extremity, while oxygen was evolved at the other. More lately, Thenard and Gay-Lussac have ascertained, that potash is decomposed, and potassium obtained, when it is made to come in contact with iron turnings heated to whiteness in a gun-barrel.

Its properties.

Potassium, the base of potash, possesses the following properties. It is white like mercury. At 50°, it is a soft malleable solid, which becomes imperfectly liquid at 60°, and perfectly so at 100°. While at 32°, it is hard, brittle, and crystallized in facets. It is not only lighter than water, but lighter than any known liquid. Its specific gravity does not exceed 0.885. Its affinity for oxygen is very great. In the open air, it is covered with a crust of potash in a few minutes. When thrown upon water, it decomposes that liquid with rapidity; hydrogen gas, holding potassium in solution, is disengaged and takes fire, which occasions the combustion of the whole potassium.

When heated in a small quantity of oxygen gas, it loses its metallic appearance, and assumes a reddish brown colour. In this state it may be considered as a peroxide of potassium.

Chlorine sets potassium on fire, and converts it into muriate of potash.

It combines with phosphorus, and forms a phosphuret, which has the colour of lead, and remains solid at a heat little short of that of boiling water. In the open air it burns, and is converted into phosphate of potash.

It combines rapidly with sulphur by heat, and heat and light are emitted at the moment of combination. The sulphuret has a grey colour, and in the open air, is soon converted into sulphate of potash.

It combines and forms alloys with all the metals tried, but these alloys are soon destroyed in the open air, or in water, and the potassium converted into potash.

Constituents of potash.

Potash, according to the experiments of Mr Davy, is composed of about

86 potassium,
14 oxygen.
———
100

According to Thenard and Gay-Lussac, it is composed of

83.371 potassium,
16.629 oxygen.
———
100

SECT. III. *Of Soda.*

Soda, how procured.

Soda, called also *fossil* or *mineral alkali*, is found in large quantities ready formed in the earth. It may be obtained also from the ashes of the different species of *salsola* and other marine plants. The process is the same as that for procuring potash.

Its properties.

When pure, it has a very strong resemblance to potash in most of its properties.

Its colour is greyish white, and it agrees with potash in its taste, smell, and action on animal bodies. Its specific gravity is 1.336.

Heat produces the same effects on it as on potash. In the open air, it absorbs water and carbonic acid, but it does not become liquid as potash does. After assuming the state of a paste, it soon dries again, and crumbles to powder.

It dissolves in water like potash, and may be obtained crystallized. The action of oxygen, of the simple combustibles and incombustibles, is similar to their action on potash. The same remark applies to the metals and their oxides.

Sodium.

Like potash, it is a compound of oxygen and a peculiar metal, to which Mr Davy, the discoverer, has given the name of *sodium*. It may be decomposed precisely in the same way as potash.

Its properties.

Sodium is a white metal like silver, solid, but very malleable, and so soft, that pieces may be welded together by strong pressure. At 120°, it begins to melt; and is completely fluid at 180°. It is not volatilized in a red heat strong enough to melt plate-glass. It conducts electricity and heat in the same manner as potassium. Its specific gravity is 0.9348.

Its affinity for oxygen is similar to that of potassium. When exposed to the air, it is soon covered with a crust of soda; but as that alkali does not deliquesce, the nucleus is not so soon destroyed as happens to potassium. Hydrogen gas does not dissolve it. Hence no combustion takes place when sodium is thrown upon water, though it rapidly decomposes that liquid.

When fused with dry soda in certain quantities, there is a division of oxygen between the soda and the base, and a protoxide of sodium is formed, of a deep brown colour. It is capable likewise of absorbing an additional dose of oxygen, and of forming a peroxide.

Composition of soda.

It burns like potassium in chlorine. It combines with phosphorus, sulphur, and the metals, like potassium. From the experiments of Mr Davy, it appears that soda is composed of

Sodium 78
Oxygen 22
———
100

According to Thenard and Gay-Lussac, it is composed of

Sodium 74.63
Oxygen 25.37
———
100

Thus it appears, that the two fixed alkalies are metallic deutoxides. It is very probable that ammonia is likewise an oxide, though the metallic base of which it consists has not yet been obtained in a separate state.

CHAP. II.

Of the Alkaline Earths.

Earth explained.

The term *earth*, in chemistry, is applied to all substances possessing the following properties.

1. Insoluble in water, or at least becoming insoluble when combined with carbonic acid.
2. Little or no taste or smell, at least when combined with carbonic acid.
3. Fixed, incombustible, and incapable, when pure, of being altered by the fire.
4. A specific gravity not exceeding 4.9.
5. When pure, capable of assuming the form of a white powder.
6. Not altered when heated with combustibles.

The earths have been divided into two classes, namely, *alkaline earths*, and *earths proper*. The alkaline are four in number, namely, *lime*, *magnesia*, *barytes*, and *strontian*.

SECT. I. *Of Lime.*

Lime.

Lime has been known from the remotest ages. It abounds in every part of the earth, constituting immense ranges of rocks and mountains. It may be obtained by *burning* those crystallized limestones called *calcareous spars*, or certain white marbles. Oyster shells, also, when burnt, yield it nearly pure.

Its properties.

Pure lime is white, moderately hard, but easily reduced to powder. Its taste is acrid like that of the fixed alkalies, and it in some measure corrodes those animal bodies to which it is applied. Its specific gravity is 2.3. It tinges vegetable blues green, and at last renders them yellow. It does not melt in the most violent heat that can be applied.

Hydrate of lime.

When water is poured upon it, the lime swells and falls to pieces, and so much heat is evolved as to evaporate a portion of the water, and even to set fire to combustible substances with which it happens to be in contact. This process is called *slacking* the lime. A portion of the water combines with the lime, and becomes solid. Hence the cause of the heat evolved. Slacked lime is composed of 3 parts lime and 1 water. It has been called *hydrate of lime*.

The difference between *limestone* and *lime* was first ascertained by Dr Black. Limestone is lime combined with carbonic acid. By burning it, the carbonic acid is driven off, and the pure lime remains.

When lime is exposed to the open air, it gradually attracts moisture, falls to powder, and, becoming saturated with carbonic acid, soon resumes its original state of limestone.

Lime-water.

Water dissolves less than 0.002 parts of its weight of lime. The solution is called lime-water. It is limpid, has an acrid taste, and changes vegetable blues to green. When exposed to the air, the lime soon combines with carbonic acid and precipitates, leaving the water pure. From the experiments of Mr Dalton, it appears that cold water dissolves twice as much lime as hot water.

Lime has the property of absorbing oxygen. Sulphur and phosphorus are the only two simple combustibles that unite with it.

Sulphuret.

Sulphuret of lime may be formed by mixing its two constituents together, and heating them in a crucible. The mass has a reddish colour. In the air it becomes greenish yellow, sulphureted hydrogen is formed, and the mass is converted into *hydrogureted sulphuret of lime*. This last compound may be formed by boiling a mixture of sulphur and lime in about ten times its weight of water. The solution has a yellow colour, and is used for absorbing oxygen from air.

Phosphuret.

Phosphuret of lime may be formed by passing phosphorus through red-hot lime in a glass tube. It has a deep brown colour, and falls to powder in the air. When thrown into water, bubbles of phosphureted hydrogen gas are emitted, which take fire as they separate from the liquid.

Lime does not unite with azote.

Lime facilitates the oxidizement of several of the metals. It dissolves some metallic oxides, as those of mercury and lead.

It does not unite with the alkalies.

Calcium.

Mr Davy has lately ascertained that lime, like the fixed alkalies, is a compound of oxygen and a peculiar metal, to which he has given the name of *calcium*. He decomposed lime, by exposing a mixture of moistened lime and red oxide of mercury to the action of a galvanic battery. A globule of mercury was placed in the middle of the mixture. The lime was decomposed, and its base united with the mercury, and formed an amalgam. The mercury was distilled off in glass tubes filled with the vapour of naphtha, and the *calcium* remained behind.

Calcium is white like silver, solid, and four or five times heavier than water. When heated, it burns brilliantly, and quick-lime is produced.

SECT. II. *Of Magnesia.*

Magnesia,

Magnesia was discovered about the beginning of the 18th century, by a Roman canon. But little was known about its nature, till Dr Black made his celebrated experiments on it in 1755.

how obtained.

It may be procured from the salt called *sulphate of magnesia*, or *Epsom salt*, by dissolving the salt in water, and pouring potash into the solution. A white matter falls; when washed and dried it is pure magnesia.

Its properties.

Magnesia is a very soft light powder, with very little taste, and destitute of smell. Its specific gravity is 2.3. It tinges vegetable blues green. It does not melt in the strongest heat that can be raised.

It is not sensibly soluble in water, and has never been exhibited in a crystallized form. When exposed to the air, it attracts carbonic acid very slowly.

It does not combine with oxygen, nor with any of the simple combustibles except sulphur. The sulphuret of magnesia may be formed, by mixing the two constituents, and exposing it to a moderate heat. The result is a yellow powder slightly agglutinated.

It does not combine with azote.

It has no action on the metals, nor is it known to combine with any of their oxides. Neither does it unite with the fixed alkalies or with lime.

Magnium.

Mr Davy succeeded in decomposing magnesia, by the same process that furnished him with the base of lime. Like lime it is composed of oxygen and a metal, to which the name of *magnium* has been given. This metal is white, sinks rapidly in water, absorbs oxygen when exposed to the air, and is converted into magnesia. It decomposes water, but not nearly so rapidly as the other alkaline metals, owing doubtless to the insolubility of magnesia.

SECT. III. *Of Barytes.*

Barytes, how obtained.

Barytes was discovered by Scheele in 1774. It is usually obtained from a heavy foliated brittle mineral, pretty common, and called *ponderous spar*, or *sulphate of barytes*. This mineral is mixed with charcoal powder, and exposed to a strong heat in a crucible. It is then dissolved in water, and saturated with nitric acid. The liquid, filtered and evaporated, yields crystals, which being exposed to a strong heat in a crucible, leave behind them an earthy matter, which is barytes.

Its properties.

Barytes thus obtained is a greyish white porous body, and may be easily reduced to powder. Its taste is more caustic than that of lime, and when swallowed it acts as a violent poison. Its specific gravity is 2.374. When water is poured on it heat is evolved, and the barytes is *slacked* precisely as happens to lime. By this means it combines with water, and is converted into *hydrate of barytes*.

Water dissolves about 0.05 of its weight of barytes. The solution has an acrid taste, and tinges vegetable blues green. Boiling water dissolves more than half its weight of barytes. As the solution cools, the barytes precipitates in crystals.

Barytes absorbs oxygen, but does not combine with any of the simple combustibles except sulphur and phosphorus. The sulphuret and phosphuret of barytes may be formed precisely in the same way as those of lime, which they resemble in most of their properties.

Barytes is not acted on by azote.

Barytes has no action on the metals, but it combines with some of the metallic oxides, and forms compounds hitherto scarcely examined.

It does not combine with the alkalies, nor has it much action upon lime or magnesia.

Barium.

Mr Davy has shown, that barytes, like the preceding earths, is a metallic oxide, being composed of oxygen and a metal, to which the name of *barium* has been given. The *barium* was obtained by the same process as that which furnished him the bases of lime and magnesia. It is a white solid metal, melts at a heat below redness, and is not volatilized at the temperature capable of melting plate-glass. It is at least four or five times heavier than water. It decomposes that liquid with great rapidity, and is converted into barytes. It undergoes the same change when exposed to the open air.

SECT. IV. *Of Strontian.*

Strontian,

Strontian was first discovered in the lead mine at Strontian in Argyleshire. It was suspected to be a peculiar earth by Dr Crawford in 1790, and its properties were soon after investigated by Dr Hope. Klaproth and Kirwan also ascertained its peculiarity. It is found sometimes combined with carbonic acid, sometimes with sulphuric acid. From the first compound, it may be obtained by making the mineral into a ball with charcoal powder, and exposing it to a violent heat; and from the second, by treating it precisely in the way described in the last Section for obtaining barytes.

how obtained.

Its properties.

Strontian thus obtained, is a porous mass of a greyish white colour. Its taste is acrid and alkaline, and it changes vegetable blues to green. Its specific gravity is 1.647. It is not poisonous.

When water is thrown upon it, the strontian becomes hot, combines with water, and is *slacked* like quick-lime. It is soluble in water, 162 parts of that liquid taking up one part of strontian. Hot water dissolves a much larger quantity, and the strontian crystallizes as the solution cools.

Strontian does not combine with oxygen. The only simple combustibles that unite with it are sulphur and phosphorus. The sulphuret and phosphuret of strontian may be formed precisely as the same compounds of lime, and possess nearly similar properties.

Strontian does not combine with azote.

It has no action on the metals, but it combines with some of the metallic oxides. It does not unite with the alkalies, nor with the other alkaline earths.

It tinges flame of a beautiful red colour. The experiment may be made by setting fire to paper dipt in an alcoholic solution of muriate of strontian.

Strontium.

Mr Davy has ascertained, that strontian, like the other alkaline earths, is composed of oxygen and a peculiar metal, to which he has given the name of *strontium*. This metal bears a close resemblance to *barium* in its properties.

CHAP. III.

Of the Earths Proper.

Of the earths proper.

THE earths proper neither neutralize acids, nor produce any change on vegetable blues. They are five in number; namely, *alumina, yttria, glucina, sirconia, silica.*

SECT. I. *Of Alumina.*

Alumina, how obtained.

Alumina may be obtained from the salt called *alum*, by the following process. Dissolve alum in water; pour ammonia into the solution, a precipitate appears; separate this precipitate and wash it; then boil it in liquid potash till the whole is dissolved; pour a solution of sal ammoniac into this liquid, a white matter precipitates, which, when washed and dried, is pure alumina.

Its properties.

Alumina is a white matter in powder. It has no taste, and when pure no smell. Its specific gravity is 2.000.

When heat is applied to alumina, it gradually loses weight, in consequence of the evaporation of moisture; at the same time its bulk is diminished. Alumina undergoes a diminution of bulk proportional to the heat to which it is exposed. Mr Wedgewood took advantage of this property, to contrive an instrument for measuring high temperatures. It consists of pieces of clay of a determinate size, and an apparatus for measuring their bulk with accuracy. One of these pieces is exposed to the heat, and the temperature is judged of by the contraction. This contraction is measured by means of two brass rules fixed to a plate. The distance between them at one extremity is 0.5 inch, and at the other extremity 0.3 inch. These rules are 24 inches long, and divided into 240 equal parts, called degrees. These degrees commence at the wide end of the scale. The first corresponds with 947° of Fahrenheit, or a red heat.

Wedgewood's pyrometer.

Alumina is not soluble in water, though it has a strong affinity for that liquid. It may be knedded with it into a very ductile paste, possessed of a good deal of tenacity. Clay owes its ductility to the alumina which it contains. It retains water with more obstinacy than any of the other earths.

Alumina has no effect upon vegetable blues. It cannot be crystallized artificially, but it is found native in beautiful crystals, constituting the precious stone called sapphyr.

It neither combines with oxygen, nor with any of the simple combustibles. Azote has no action on it.

It does not unite with the metals, but it has an affinity for several metallic peroxides.

The fixed alkalies dissolve it readily when they are in a state of solution in water; but they do not melt with it when heated in a crucible. Barytes and strontian combine with alumina, both when heated with it in a crucible, and when boiled with it in water. It has a strong affinity for lime, and easily melts with it when it exceeds the lime in quantity; but when the lime exceeds, fusion does not take place. Magnesia and alumina have no action on each other.

Alumium.

It is probable that alumina, like the alkaline salts, is a metallic oxide. This notion was entertained long ago by chemists. Davy endeavoured to obtain the metallic basis by means of galvanism, but did not succeed, though he has rendered it probable that a metal exists in it. To this metal he proposes to give the name of *alumium*.

SECT. II. *Of Yttria.*

Yttria, how obtained.

This earth was discovered by Gadoline in a Swedish mineral of a black colour, to which the name Gadolinite has been given. To obtain it, the mineral is reduced to powder, dissolved in nitro-muriatic acid, filtered, evaporated to dryness, redissolved, filtered, evaporated to dryness, the residual salt is heated to redness, redissolved in water, and ammonia poured into the solution. A white powder falls, which is yttria.

Yttria, thus procured, is a fine white powder without taste or smell. It has no action on vegetable blues. Heat does not melt it. Its specific gravity is 4.842.

Its properties.

It is insoluble in water, but, like alumina, it retains a portion of that liquid, though not with so much obstinacy.

It is insoluble in the liquid fixed alkalies; but it dissolves in carbonate of ammonia, and in all the other alkaline carbonates.

It does not combine with oxygen, the simple combustibles, or azote.

According to Ekeberg, when yttria is treated with muriatic acid, a quantity of chloric gas is formed. If so, it must contain oxygen, and of course be a metallic oxide. The opinion is probable, though no attempts have been made to decompose yttria by means of galvanism.

Sect. III. *Of Glucina.*

Glucina, how obtained.

Glucina was discovered by Vauquelin in the two minerals called beryl and emerald. They are pounded and fused with thrice their weight of potash. The mass is dissolved in muriatic acid, and the solution evaporated to dryness. The residuum is digested in water, and thrown upon the filter. The liquid which passes through is mixed with carbonate of potash, and the precipitate dissolved in sulphuric acid. Sulphate of potash being added to the solution, it is laid aside for some time. Alum crystals gradually form. When no more appear, filter the liquid, add carbonate of ammonia in excess, filter again and boil the liquid for some time. A white powder precipitates, which is glucina.

Its properties.

Glucina is a soft white powder, without either taste or smell. It adheres strongly to the tongue, produces no change on vegetable blues, does not melt when heated, and does not harden and contract like alumina. Its specific gravity is 2.976. It is insoluble in water, but forms with it a paste having some ductility.

It does not combine with oxygen, nor with the simple combustibles, or azote.

It is soluble in the liquid fixed alkalies, like alumina; is insoluble in ammonia, but, like yttria, soluble in carbonate of ammonia.

Mr Davy has rendered it probable, that it is a metallic peroxide. To the metallic basis he proposes to give the name of *glucium.*

Sect. IV. *Of Zirconia.*

Zirconia, how obtained.

Zirconia was discovered by Klaproth in the two minerals called *jargon* or *zircon*, and the hyacinth. Fuse the pounded mineral with thrice its weight of potash; wash the mass in pure water till the whole of the potash is extracted, then dissolve the residuum as far as possible in muriatic acid; boil the solution, filter and add a quantity of potash. The zirconia precipitates in the state of a fine powder.

Its properties.

Zirconia is a white powder with a harsh feel. It has neither taste nor odour, is infusible before the blowpipe, but when violently heated, acquires the appearance of porcelain. In this state it is hard, and its specific gravity is 4.3. It is insoluble in water, but, when precipitated from a solution and dried slowly, it retains water, and assumes the appearance of gum arabic.

It does not combine with oxygen, simple combustibles, azote, nor metals. But it has an affinity for several metallic oxides.

It is insoluble in liquid alkalies, and infusible with them; but it is soluble in alkaline carbonates.

Mr Davy has made it probable, that it is a metallic peroxide. To the metallic basis he proposes to give the name of *zirconium.*

Sect. V. *Of Silica.*

Silica, how obtained.

The minerals called *quartz*, *rock-crystal*, *flint*, &c. consist almost entirely of this earth. It may be obtained in the following manner. Melt in a crucible a mixture of one part quartz powder, and three parts potash; dissolve the mass in muriatic acid, and evaporate to dryness; towards the end of the evaporation, the liquid assumes the form of a jelly; wash the residue in water, and dry it.

Its properties.

Silica, thus obtained, is a fine white powder, with a harsh feel, and without either taste or smell. Its specific gravity is 2.66. It has no effect on vegetable colours, is insoluble in water, and infusible by the heat of our furnaces. It does not form a ductile paste with water, like alumina. It is found native crystallized, most commonly in hexagonal prisms, terminated by six-sided pyramids.

It does not combine with oxygen, the simple combustibles, simple incombustibles, or the metals. It may be fused with several of the metallic oxides.

The fixed alkalies may be fused with it into glass. Ammonia has no action on it. It may be combined with barytes, strontian, lime, and magnesia, by heat. There is a strong affinity between it and alumina.

Mr Davy has rendered it probable, that silica, like the other earths, is a metallic peroxide. To the metallic basis of it he proposes to give the name of *silicium.*

Chap. I.

Of Oxides.

Oxide explained.

Many bodies, as we have seen already, are capable of combining with oxygen. Now, the compounds into which oxygen enters are of two kinds. They either possess the properties of *acids*, or they are destitute of these properties. To the first class the term *acid* has been applied; to the second that of *oxide*. By *oxide*, then, is meant a combination of oxygen and some other substance destitute of the properties belonging to acids. It is very common to find the same base combine with different doses of oxygen, and form both *acids* and *oxides*. In all these cases, the *smaller* proportion of oxygen constitutes the *oxide*, and the *larger* the *acid*. Hence it follows, that oxides always contain less oxygen than acids with the same base.

The oxides which we have to examine, are combinations of oxygen with the simple combustibles and incombustibles: For the metallic oxides have been already described in the First Book, while treating of the metals. All that is known of the oxides of phosphorus and sulphur has also been stated. We have only to examine in this place, therefore, the oxides of hydrogen, carbon, and azote.

SECT. I. *Of the Oxide of Hydrogen, or Water.*

Oxide of hydrogen.

This well known liquid is found in abundance in every part of the world. When pure, in which state it may be obtained by distillation, it is destitute of colour, taste, and smell.

At the temperature of 40°, a cubic foot of pure water weighs 437102.4946 grains troy, or 999.0914161 ounces avoirdupois. Hence a cubic inch of water at 40° weighs 252.953 grains, and at 60° 252.72 grains. The specific gravity of water is always supposed 1.000, and it is made the measure of the specific gravity of every other body.

When cooled down to 32°, it crystallizes and becomes *ice*. At 212° it boils, and is converted into *steam*, an elastic fluid, invisible like air, and about 1800 times more bulky than water. The boiling point of water is somewhat altered by dissolving salt in it. Some salts raise the boiling point, others lower it a little, while some produce both effects according to the proportion employed.

Water is not altered by heat. It absorbs a little air, and a certain proportion of all gases exposed to it. By long boiling, or by being placed in an exhausted receiver, it is freed from the greatest part of this air.

Water has no action on the simple combustibles while cold; but, at a red heat, charcoal decomposes it. The action of phosphorus is not known. Sulphur, as far as is known, does not decompose it.

Of the metals, iron, zinc, antimony, and tin, decompose it when assisted by heat; silver, gold, copper, and platinum, have no effect on it. The action of the other metals has not been ascertained. The metallic bases of the alkalies and earths decompose it with great rapidity, at the usual temperature of the atmosphere.

Water dissolves the alkalies and alkaline earths. The earths proper are insoluble in it. It dissolves also acids and salts, and is capable of combining with a great variety of bodies. Water unites to bodies two different ways. Some it dissolves, and the compound becomes liquid like water. In this way it dissolves sugar, common salt, and many other bodies. Other bodies combine with it without losing their solidity. The water loses its liquid form, and assumes that of the body with which it unites. In this way it combines with lime, with alumina, with many salts, and with various metallic oxides. When the compound of water with another substance remains liquid, the proportion of water is unlimited; but when the compound formed is solid, the water combines always in a certain determinate proportion. To the first kind of compound, the name of *solution* has been given; to the second, the term *hydrate* has been applied. Thus, *slacked lime* is called *hydrate of lime;* the crystals of barytes and strontian are called *hydrates of barytes and strontian*. Most of the metallic hydrates have lively colours, a strong taste, and are easily soluble in acids; while the oxide which constitutes the base of the hydrate is usually duller in its colour, often tasteless, and always more difficultly soluble in acids. The hydrate of copper is blue, that of nickel and iron green, that of cobalt red, and that of tin white.

All the gases, in their usual state, contain a quantity of water, from which they are best freed by exposure to a very low temperature.

The ancients considered water as an elementary substance. Van Helmont endeavoured to prove, that plants could be nourished by pure water alone, and, of course, that it could be converted into all the substances found in vegetables. Boyle thought that, by long digestion in glass vessels, it could be converted into silica. His experiment was confirmed by Margraff. But Scheele and Lavoisier proved, that the silica was obtained by the decomposition of the glass vessel in which the experiment was made. Mr Cavendish, in 1781, ascertained that water is a compound of oxygen and hydrogen, nearly in the proportion of seven parts of the former, and one of the latter; and this discovery was confirmed by a number of very laborious and rigid experiments.

SECT. II. *Of Carbonic Oxide.*

Carbonic oxide.

The substance at present known by the name of *carbonic oxide*, is a gas which was confounded with carbureted hydrogen, till Dr Priestley drew the attention of chemists to it, in a dissertation which he published in defence of the doctrine of phlogiston. It was examined, in consequence, by Mr Cruikshanks, who showed it to be a compound of *oxygen* and *carbon*, and not of *hydrogen* and *carbon*, as Priestley had supposed. Clement and Desormes also analysed it with the same result.

How obtained.

It may be obtained most readily by mixing together equal weights of iron filings and chalk, each as dry as possible, and exposing them to a red heat in an iron retort. A gas comes over in abundance. It consists partly of *carbonic acid*, partly of *carbonic oxide*. The first gas is removed by washing in lime-water. The carbonic oxide remains behind.

Its properties.

Carbonic oxide is invisible, and possesses the mechanical properties of common air. Its specific gravity is 0.956, that of air being 1.000. No animal can breathe it without death. No combustible substance will burn in it.

It burns with a blue flame, giving out but little light, and is wholly converted into carbonic acid gas. When mixed with oxygen gas, and kindled by means of an electric spark, 100 parts of it require 45 parts by bulk of oxygen gas for complete combustion. The result is about 90 parts of carbonic acid gas. From this experiment it has been deduced, that carbonic oxide is composed of

Composition.

41 carbon.
59 oxygen.
———
100

The simple combustibles have but little action on this gas. Hydrogen has none, even at a red heat, nor charcoal, nor sulphur. But it dissolves a little phosphorus, and acquires the property of burning with a yellow flame.

The simple incombustibles have no effect on it at any temperature tried. Chlorine gradually destroys it over water, converting it into carbonic acid gas. This mixture cannot be kindled by electricity; whereas a mixture of chlorine and carbureted hydrogen burn directly when an electric spark is passed through them.

Its action on metals and their oxides has been but imperfectly examined. Neither the alkalies nor the earths have any action on it whatever.

Sect. III. *Of the Oxides of Azote.*

Oxides of azote.

Azote and oxygen form two different oxides, both gases, and both discovered by Dr Priestley. The first has been called *nitrous acid gas*, the second *nitrous gas*, or *nitric oxide gas*.

1. *Nitrous Oxide Gas.*

Nitrous oxide gas.

This gas was discovered by Dr Priestley in 1776, and called by him *dephlogisticated nitrous gas*. The associated Dutch chemists examined it in 1793, and ascertained its composition. But for the best account of it, we are indebted to Mr Davy.

How obtained.

It may be obtained by exposing the salt called *nitrate of ammonia* in a retort to a heat between 340° and 500°. It melts and emits abundance of gas, which may be collected in jars of water.

Its properties.

Thus obtained, it has all the mechanical properties of air. Its specific gravity is 1.603, that of air being 1.000.

It supports combustion better than common air, almost as well as oxygen gas, but for a much shorter time. But combustibles do not burn in it, unless previously in a state of ignition.

It may be breathed for a short time, and produces effects similar to intoxication.

Water absorbs nearly its own bulk of this gas, and acquires a sweetish taste; but its other properties are not perceptibly altered. It may be driven off from the water unaltered by means of heat.

It is not altered by light, nor by a moderate heat. But by a red heat it is decomposed, and converted into *nitric acid* and *common air*.

Oxygen, or common air, has no action on this gas.

Sulphur, if introduced into this gas while burning with a blue flame, is immediately extinguished; but, if it be burning with a violet flame, it continues to burn for some time with great brilliancy with a fine red flame. The products are sulphuric acid and azote.

Phosphorus, when touched with a wire white hot, burns with great brilliancy in this gas. The products are azotic gas, phosphoric acid, and nitric acid.

Charcoal may be kindled in it by means of a burning glass. The products are carbonic acid gas, and azotic gas.

Hydrogen detonates with it by means of electricity. According to Mr Davy, 39 measures of nitrous oxide consume 40 measures of hydrogen, and after the combustion 41 measures of azotic gas remain. From this experiment it has been concluded, that nitrous oxide is composed by weight of

63 azote.
37 oxygen.
———
100

Composition.

Sulphureted, phosphureted, and carbureted hydrogen gas likewise burn when mixed with nitrous oxide, and kindled.

Neither azote nor muriatic acid produce any effect upon this gas.

Some of the metals, as iron and zinc, burn or may be oxidized in it.

It has the property of combining with alkalies, and of forming a peculiar species of salt, to which the name of *azotites* may be given. Mr Davy, to whom we are indebted for the discovery of these compounds, did not succeed in combining nitrous oxide with ammonia and the earths, but he has rendered it probable that such compounds are possible.

2. *Nitrous Gas.*

Nitrous gas.

This gas was accidentally obtained by Dr Hales; but its properties were first investigated, and its nature ascertained, by Dr Priestley.

How obtained.

To obtain it, dissolve copper or silver in nitric acid diluted with water, a gas separates, which may be collected in jars over water, and is the gas in question.

Its properties.

It possesses the mechanical properties of common air. Its specific gravity is 1.094, that of air being 1.000.

It is exceedingly noxious to animals, producing instant suffocation whenever they attempt to breathe it.

Most combustible substances refuse to burn in it. But pyrophorus burns in it with great splendour; and Homberg's phosphorus takes fire in it spontaneously, just as in common air. Dr Henry has ascertained, that ammoniacal gas, when mixed with it, detonates by means of electricity.

When mixed with common air, or oxygen gas, a yellow colour appears; and if the mixture be standing over water, its bulk gradually diminishes very considerably. The yellow colour is owing to the presence of nitrous acid which is formed, and the diminution of bulk to the gradual absorption of that acid by the water. The cause of this remarkable phenomenon is obvious. The nitrous gas combines with the oxygen, and forms nitrous acid. Hence the diminution of bulk depends upon the quantity of oxygen present. There is a good deal of difference in the result obtained by chemists of the amount of the diminution of bulk which ensues. According to Dalton, 21 measures of oxygen gas unite either with 36 measures of nitrous gas, or with 72 measures. According to Gay-Lussac, 100 measures of oxygen gas unite either with 200 or with 300 measures of nitrous gas, according to circumstances.

Nitrous gas, by electricity, is converted into nitrous acid and azote.

Water, according to Dr Priestley, absorbs about one-tenth its bulk of this gas; according to Dr Henry, about one-twentieth of its bulk.

It is decomposed by phosphorus and charcoal, and probably also by sulphur at a very high temperature. Hydrogen gas mixed with it burns with a green flame. This mixture, according to Fourcroy, detonates when passed through a red-hot tube.

Neither azote nor muriatic acid produce any effect upon it.

Several of the metals decompose it. When kept for some time in contact with iron, its bulk diminishes, and it is converted into nitrous oxide.

It is absorbed unchanged by a solution of green sulphate or muriate of iron. The liquid acquires a deep brown colour, and, when kept, becomes blue. The gas may be expelled unaltered by heat.

The following bodies convert this gas into nitrous oxide. Alkaline sulphites, hydrogureted sulphurets, muriate of tin, sulphureted hydrogen gas, iron or zinc filings moistened with water.

Composition according to Davy.

From the analysis of Mr Davy, it appears to be composed by weight of

57 oxygen.
43 azote.
———
100

Composition according to Gay-Lussac.

According to Gay-Lussac, nitrous gas is composed of equal bulks of oxygen and azotic gas united together, and its specific gravity is exactly the mean. Hence no change of bulk takes place when they are combined. This would give us nitrous gas composed by weight of

53 oxygen.
47 azote.
———
100

Chap. V.

Of Acids.

Acids.

The word *acid*, originally synonymous with *sour*, is at present applied to all bodies possessed of the following properties:

1. When applied to the tongue, they excite that sensation which is called *sour* or *acid*.

2. They change the blue colours of vegetables to red.

3. They unite with water in almost every proportion.

4. They combine with the alkalies, earths, and metallic oxides, and form a class of bodies called *salts*.

Every acid does not possess the whole of these properties. But all of them possess a sufficient number to distinguish them from other bodies. The second and fourth properties are considered as the most important and essential.

It was at one time believed, that there existed only one acid in nature, and that all bodies owed their acidity to the presence of that acid.

This notion was long a favourite one among chemists, and sulphuric and phosphoric acids were pitched upon as the universal acids. But the claims of neither could stand the test of a rigid examination. At last Mr Lavoisier proved, that many substances were capable of combining with *oxygen*, and by that means were converted into acids. Hence oxygen was termed the *acidifying principle*.

All that can be meant by this appellation, is only that many acids contain oxygen as a constituent, and that, when deprived of oxygen, they lose their acid characters. In this sense the appellation is correct enough. But it is not true that oxygen itself possesses acid characters; neither has it been proved that it exists in every acid. Many substances contain oxygen which are entirely destitute of acid properties. Thus water, alkalies, and alkaline earths, contain it. Yet it would be absurd to consider any of these bodies as acids. As the acids are very numerous, and very heterogeneous in their properties, it will be of some importance to subdivide them into classes. They may be arranged under three heads: 1. Acid products; 2. Acid supporters; 3. Combustible acids.

Class I. *Acid Products.*

Acid products.

All the acids belonging to this class possess the following properties:

1. They may be formed by combustion. Of course their base is a simple combustible.

2. They are incombustible.

3. They resist a violent heat without decomposition. But to this there are some exceptions.

4. They are decomposed by the joint action of a combustible body and caloric.

5. Oxygen is an essential ingredient in all of them.

Some of the combustibles combine with two doses of oxygen, and form two distinct acids. When that happens, the acid containing the smallest dose of oxygen is distinguished by the termination *ous*, while that which contains a maximum of oxygen is distinguished by the termination *ic*. Thus *sulphurous* and *sulphuric acids*. The first contains the least, and the second the most oxygen.

Table of acid products, &c.

The following Table exhibits the names of the acid products, their bases, and the proportion of oxygen in each, combined with 100 of the bases as far as it is known at present.

Names.	Bases.	Proportion of Oxygen to 100 Base.
Sulphuric Sulphurous	Sulphur	150 100
Phosphoric Phosphorous	Phosphorus	114.7 58 ?
Carbonic	Carbon	25
Boracic	Boracium	200
Fluoric	Unknown	

Sect. I. *Of Sulphuric Acid.*

Sulphuric acid.

Sulphuric acid seems to have been discovered by the alchymists. It was long obtained by distilling the salt called *green vitriol*, or *sulphate of iron*. Hence the names *oil of vitriol* and *vitriolic acid* originally applied to it. It is now procured by burning a mixture of sulphur and nitre in chambers lined with lead, the bottom of which is covered with wa-

How obtained.

ter. The acid formed is dissolved by the water, and is concentrated by distillation in glass retorts.

Sulphuric acid is liquid, somewhat of an oily consistency, transparent and colourless as water, without any smell, and of a very strong acid taste. It destroys the texture of animal and vegetable substances.

Its properties.

Its specific gravity, when as strong as possible, is about 1.85. It changes all vegetable blues to red, except indigo. When of the specific gravity 1.842, it boils at 546°. When exposed to cold, it crystallizes or congeals. The temperature necessary depends upon the strength. When of the specific gravity 1.780, it freezes at 45°. When stronger or weaker, it requires a much greater degree of cold.

It has a strong attraction for water, and when exposed to the atmosphere, imbibes nearly seven times its weight of that liquid. When the two liquids are mixed together, a considerable heat is evolved. Thus four parts of acid and one of water raises the thermometer to about 300°. The density of this mixture is always considerably greater than the mean. From the experiments of Kirwan, it appears that the strongest sulphuric acid of commerce contains almost 1·5th of water, the remaining 4·5ths are pure acid.

Table of the strength and boiling point of sulphuric acid.

The following Table, drawn up by Mr Dalton from his own experiments, exhibits the strength and the boiling point of sulphuric acid of various densities.

Sp. Gr. of acid.	Real acid per cent. by weight.	Boiling point.
1.850	81	620°
1.849	80	605
1.848	79	590
1.847	78	575
1.845	77	560
1.842	76	545
1.838	75	530
1.833	74	515
1.827	73	501
1.819	72	487
1.810	71	473
1.801	70	460
1.791	69	447
1.780	68	435
1.769	67	422°
1.757	66	410
1.744	65	400
1.730	64	391
1.715	63	382
1.699	62	374
1.684	61	367
1.670	60	360
1.650	58.6	350
1.520	50	290
1.408	40	260
1.30+	30	240
1.200	20	224
1.10—	10	218

Composition.

From the most accurate experiments hitherto made, sulphuric acid appears to be composed of

60 oxygen.
40 sulphur.
———
100

This acid is not altered by exposure to light nor heat. Oxygen gas does not act upon it nor combine with it.

The simple combustibles have but little effect upon it at the ordinary temperature of the atmosphere, but when assisted by heat, they all decompose it. When hydrogen gas and the acid are passed through a red-hot tube, water is formed, and sulphur deposited. Charcoal absorbs oxygen from it, and readily converts it into sulphurous acid, or into sulphur, if the heat be long continued. Phosphorus and boracium produce the same effect. Sulphur, when boiled with it, readily converts it into sulphurous acid.

Azote has no action on it; but it readily absorbs muriatic acid, and forms a smoking compound, which acts powerfully upon some metals.

Sulphuric acid, when concentrated, has little action on the metals. When diluted, it dissolves iron and zinc with rapidity, water is decomposed, and hydrogen gas emitted. When heated, it oxidizes several of the metals, and sulphurous acid is exhaled. On gold and platinum it produces no effect whatever.

It unites readily with the alkalies, earths, and metallic oxides; and forms with them a class of bodies called *sulphates*.

It absorbs a good deal of nitrous gas, and acquires, in consequence, a purplish colour.

This acid is of great importance, both in chemistry and the arts.

SECT. II. *Of Sulphurous Acid.*

Sulphurous acid. How obtained.

The existence of this acid was pointed out by Stahl, but Priestley was the first who procured it in a separate state. It may be obtained by distilling in a retort a mixture of two parts sulphuric acid, and one part of mercury. An effervescence takes place, and a gas comes over, which may be received in jars over mercury.

Its properties.

It is colourless, and possesses the mechanical properties of common air. It has a strong and suffocating odour, precisely the same as that emitted by burning sulphur. Its specific gravity is 2.265, that of air being 1.000. It reddens vegetable blues, and gradually destroys the colour altogether.

When strongly heated, sulphur is deposited, and sulphuric acid formed. When exposed to the temperature of —18°, it is condensed into a liquid.

Water absorbs 33 times its bulk of this gas. The liquid has the smell of the gas, an acid and sulphureous taste, and the specific gravity 1.0513. It may be frozen without parting with the gas. But when heated, the gas is expelled. When this liquid is left to itself, it gradually absorbs oxygen, and the acid is converted into the sulphuric.

Sulphur and phosphorus seem to have no action on this acid; but hydrogen and charcoal decompose it when assisted by heat, and sulphur is evolved. Neither azote nor muriatic acid produce any effect upon it.

It oxidizes and dissolves iron, zinc, and manganese.

It combines with the salifiable bases, and forms salts called *sulphites*.

Sulphuric acid absorbs it, and forms a singular compound called *glasial sulphuric acid*, which readily becomes solid, and smokes when exposed to the air.

Composition.

Its constituents are 50 sulphur,
50 oxygen.
———
100

SECT. III. *Of Phosphoric Acid.*

Phosphoric acid.

This acid was first mentioned by Boyle, but its properties were investigated many years after. It may be obtained by burning phosphorus, or by dissolving phosphorus in nitric acid, and evaporating the liquid to dryness.

How obtained.

Its properties.

In this state it is solid, colourless, and transparent, not unlike glass. It reddens vegetable blues, has no smell, but has a very acid taste. When exposed to the air, it attracts moisture, and gradually runs into an oily-like fluid. Its specific gravity when in the state of glass is 2.8516; when in the liquid state, 1.417.

It is very soluble in water, and is said to be capable of crystallizing, but it is difficult to obtain it in that state.

Oxygen has no effect upon it. None of the simple combustibles are known to be capable of decomposing it, except charcoal. When strongly heated with this substance, phosphorus is disengaged. The simple incombustibles have no effect on it.

It is capable of oxidizing and dissolving some of the metals; but its action on these bodies is by no means strong.

It combines with the salifiable bases, and forms a class of salts called *phosphates*.

Composition.

According to the experiments of Rose, it is composed of

46.5	phosphorus,
53.5	oxygen.
100.0	

Sect. IV. *Of Phosphorous Acid.*

Phosphorous acid.

This acid was known earlier than the preceding. For a long time they were confounded. Lavoisier was, perhaps, the first who accurately distinguished them. It may be obtained by exposing phosphorus to the open air: it gradually absorbs oxygen, and runs into a liquid, which is the acid in question.

How obtained.

Its properties.

It is a viscid colourless liquid, having a very acid taste, and emitting the smell of garlic, especially when heated. It combines with water in any proportion. When evaporated to dryness and heated, it gives out phosphureted hydrogen gas, which burns when it comes in contact with the air. This continues for a long time, and at last the acid is converted into the phosphoric. If nitric acid be poured upon it, this change takes place much more easily and speedily.

The action of the simple combustibles, the incombustibles, and the metals on this acid, is similar to their action on phosphoric acid.

It combines with the different salifiable bases, and forms a class of salts called *phosphites*.

Sulphuric acid, by the assistance of heat, converts it into phosphoric acid.

It has been ascertained that this acid contains less oxygen than the phosphoric, but the actual proportion has not been determined

Sect. V. *Of Carbonic Acid.*

Carbonic acid.

This acid was discovered by Dr Black. Its properties were afterwards investigated by Mr Cavendish and Dr Priestley, and its composition ascertained by Mr Lavoisier. It was at first called *fixed air*. Mr Lavoisier, after ascertaining its base, gave it the name which it now bears. Every chemist almost of eminence, during the last 50 years, has added something to our knowledge of the properties of this remarkable substance.

How obtained.

It may be obtained by burning charcoal, or more easily by pouring muriatic acid on chalk in a glass retort, and receiving the gas which is extricated in glass jars over water. This gas is the acid in question.

Its properties.

It is invisible, and possesses the mechanical properties of air. No combustible will burn in it. It is unfit for respiration. It affects the nostrils with a kind of pungent sensation, but when diluted with air, it has no smell whatever. Its specific gravity is 1.500, that of air being 1.000. It reddens very delicate vegetable blues.

Atmospheric air contains about $\frac{1}{1000}$ of its bulk of this gas.

It is not altered by passing it through a red hot tube; but when electric sparks are passed through it for a long time, its bulk increases, and a portion of carbonic oxide is evolved.

Water absorbs it when placed in contact with it. The rapidity of the absorption is much increased by agitation. Water absorbs its own bulk of this gas at the temperature of 41°. The water acquires a sour taste, a sparkling appearance, and the property of reddening vegetable blues. When heated or frozen, the gas is extricated. It makes its escape also if the liquid be left exposed to the open air.

Carbonic acid is not acted upon by oxygen, nor, as far as is known, is it altered by any of the simple combustibles, incombustibles, or metals. But several of these bodies, as charcoal, phosphorus and different metals, have the property of decomposing it at a red heat, when it is in combination with lime, barytes, or strontian. In these cases a quantity of carbonic oxide is usually evolved.

It combines with the salifiable bases, and forms a class of salts called *carbonates*.

Composition.

From the most exact experiments hitherto made, we may consider this acid as composed very nearly of

28	carbon.
72	oxygen.
100	

Sect. VI. *Of Boracic Acid.*

Boracic acid.

This acid is obtained from the salt called *borax*, brought to Europe from the East, where it is found chiefly at the bottom of some lakes in Thibet and China. It was first extracted from borax by Homberg, and its nature was ascertained by Baron. To obtain it, dissolve borax in hot water, and add sulphuric acid till the liquid assumes a sensibly acid taste. As the liquid cools, it deposites white crystalline scales, which are *boracic acid*.

How obtained.

Its properties.

Thus obtained, it has the form of thin hexagonal scales of a silvery whiteness. Its taste is sourish and bitterish. It has no smell. It reddens vegetable blues. Its specific gravity, while in scales, is 1.479, when melted 1.803.

It is not altered by light nor heat. In a red heat it melts into a transparent colourless glass, which becomes somewhat opake when exposed to the air, but does not attract moisture.

Boiling water does not dissolve more than 0.02 of this acid, and cold water still less.

Neither oxygen, the simple combustibles, incombustibles, or metals, produce any effect upon this acid. But when heated with potassium it is decomposed, and its base *boracium* separated.

Composition.

From the experiments of Davy, we may conclude that boracic acid is composed of about

33	boracium.
67	oxygen.
100	

It is soluble in alcohol, and alcohol containing it burns with a green coloured flame. It dissolves also in some of the oils.

It is hardly capable of oxidizing any of the metals except iron and zinc.

It combines with the salifiable bases, and forms a class of salts called *borates*.

SECT. VII. *Of Fluoric Acid.*

Fluoric acid.

This acid was discovered by Scheele. He obtained it from a pretty common and beautiful mineral called *fluor spar*, and in this country often Derbyshire spar. This mineral is a compound of fluoric acid and lime. Dr Priestley first obtained the acid in a separate state.

How obtained.

To procure this acid, pour sulphuric acid on the pounded spar, and apply heat. A gas comes over, which must be received over mercury. It is the acid in question.

Its properties.

This gas possesses the mechanical properties of air. It does not support combustion, nor can animals breathe it. It smokes when mixed with the atmosphere, and has a smell similar to that of muriatic acid.

It is not altered by exposure to heat or light.

Water absorbs it rapidly. If glass vessels have been employed to procure it, a jelly is deposited as soon as it comes in contact with the water. This jelly consists of silica, which the gas has dissolved from the glass, and which it held in solution. No method has been yet discovered of obtaining fluoric acid gas free from foreign matter. If leaden vessels be used, the gas does not assume the elastic form, at least we could not procure it by means of these vessels. When fluor spar and vitreous boracic acid are heated together, a gas is obtained, which is a combination of the two acids, to which Thenard and Gay-Lussac, who discovered this compound gas, have given the name of *fluoboracic* acid gas.

Neither oxygen, the simple combustibles, incombustibles, or metals, as far as is known, produce any effect upon this gas. It does not act powerfully upon the metals.

The fluoboracic acid is absorbed by water, and forms a very powerful acid liquid, nearly as heavy as sulphuric acid, and capable of resisting as strong a heat before it is volatilized.

One of the most curious properties of fluoric acid is the ease with which it corrodes glass, when that substance is exposed to its fumes. In consequence of this property, it has been employed to etch upon glass.

It combines with the different bases, and forms a class of salts called *fluates*.

All attempts to decompose this acid have failed, in consequence chiefly of the impossibility of making experiments on it in a state of purity.

CLASS II. *Acid Supporters.*

Acid supporters. Their properties.

The acid supporters are distinguished by the following properties:

1. They cannot be produced by combustion. Hence their base is either a simple incombustible or a metal.

2. They support combustion. Hence they acidify the combustible bases, and oxidize the metals.

3. They are decomposed at a high temperature, their oxygen making its escape in the state of gas.

The only acid supporters known at present, are those which have the simple incombustibles and arsenic for their bases. From analogy, we refer the whole of the metallic acids to this head.

Table of acid supporters, &c.

The following Table exhibits a view of all the acid supporters, of their bases, and of the proportion of their constituents, as far as that has been ascertained.

Names.	Bases.	Proportion of Oxygen to 100 base.
Nitric Nitrous	Azote	236
Arsenic	Arsenic	53
Tungstic	Tungsten	25
Molybdic	Molybdenum	50
Chromic	Chromium	200
Columbic	Columbium	

Oxygen is an essential constituent of all these acids, as well as of those belonging to the first class.

SECT. I. *Of Nitric Acid.*

Nitric acid.

This acid seems to have been first obtained in a separate state by Raymond Lully, one of the most celebrated of the alchymists. It was called at first *water of nitre*, *aqua fortis*, *spirit of nitre*.

How obtained.

It may be obtained, by distilling a mixture of three parts nitre and one of sulphuric acid in a glass retort.

Its properties.

The acid thus obtained has a yellow colour; but, if kept for a short time in a boiling heat, it becomes colourless. It has a peculiar smell, it smokes when exposed to the atmosphere. Its taste is extremely acid, and it is one of the most corrosive substances known, tinging the skin instantly of an indelible yellow, and very soon destroying its texture entirely. It converts vegetable blues to red. Its specific gravity when strongest never exceeds 1.583. It contains mixed with it a considerable portion of water, from which it cannot be freed. When strongest, this water amounts to about one-fifth of the whole.

Table of the strength and boiling point of nitric acid.

The following Table, by Mr Dalton, exhibits the strength and boiling point of this acid when of various densities.

Specific gravity of acid.	Real acid per cent. by weight.	Boiling point.
1.62	82.7	
1.54	72.5	175°
1.50	68	210
1.45	58.4	210
1.42	54.4	248
1.40	51.2	247
1.35	44.3	242
1.30	37.4	236
1.26	32 3	232
1.22	28.5	229
1.20	25.4	226
1.18	23	223
1.17	21	221
1.16	19.3	220
1.15	17.8	219
1.14	16.6	219

When of the specific gravity 1.42 it boils at 248°, and may be distilled over without alteration. When cooled sufficiently it congeals, and the freezing point varies exceedingly according to the strength of the acid. There is a certain strength at which it congeals most easily, and, if it be either stronger or weaker, the freezing point is considerably lower.

Oxygen has no effect upon this acid; but all the simple combustibles decompose it. When poured upon charcoal, phosphorus, or sulphur, at a high temperature, it sets them on fire. When diluted, it effervesces with these bodies, and acidifies them. Hydrogen gas does not act upon it at the common temperature of the atmosphere, but when passed with it through a red hot tube, it detonates, water is formed, and azotic gas disengaged. Boracium is readily converted by it into boracic acid. When poured upon the volatile oils, and even upon several of the fixed oils, it sets them on fire. If it be previously mixed with a little sulphuric acid, it sets almost all the oils on fire.

Azote has no action on this acid, but muriatic acid forms with it the compound called *aqua regia*, or *nitro-muriatic acid.*

It is capable of oxidizing all the metals, except gold, platinum, and titanium. With most of the oxides it combines, though some, as the peroxides of tin and antimony, are insoluble in it. It even sets fire to some of the metals, when poured upon them in fusion.

It absorbs nitrous gas in great abundance, and becomes first yellow, then orange, then olive, and at last green, according to the proportion of gas present. Acid thus contaminated with nitrous gas was formerly called *dephlogisticated nitric acid*, and *nitrous acid;* on the supposition that it was nitric acid deprived of a portion of its oxygen. When fully saturated with nitrous gas, it assumes a gaseous state, and is known by the name of gaseous vapour.

Nitric acid combines with the different salifiable bases, and forms a class of salts called nitrates.

Composition.

It has been ascertained, that this acid is a compound of oxygen and azote in the following proportions.

29.77 azote.
70.23 oxygen.
100.00

Sect. II. *Of Nitrous Acid.*

Nitrous acid.

When *nitre*, which is a compound of nitric acid and potash, is exposed to a red heat, it yields a considerable portion of oxygen gas. If the process be conducted with the proper precautions, and stopped in time, the nitre still retains the properties of a neutral salt. But the acid which it contains is obviously in a different state, since it has lost a considerable part of its oxygen. To this new state the term *nitrous acid* is applied.

In this state it was discovered by Scheele, but all attempts to obtain the acid by itself have failed. It is decomposed apparently whenever it is separated from the potash; for fumes of nitrous gas immediately make their appearance.

Sect. III. *Of Arsenic Acid.*

Arsenic acid.

This acid was discovered by Scheele. It may be formed in the following manner: Mix in a retort one part of muriatic acid, four parts of white oxide of arsenic, and 12 parts of nitric acid of the specific gravity 1.25. Boil the mixture till the oxide disappear, and nitrous fumes cease to be disengaged; then evaporate to dryness, and expose the mass to a low red heat. The matter thus obtained is solid *arsenic acid.*

How obtained.

Its properties.

It is a white solid mass nearly tasteless, of the specific gravity 3.391. It is very fixed. It melts at a red heat, and is converted into glass.

It dissolves slowly in cold, but rapidly in hot water, and by cautious evaporation may be obtained in crystals. The taste of the solution is acid, caustic, and metallic.

Oxygen has no effect on it. The simple combustibles decompose it when assisted by heat, and sometimes take fire, in consequence of its action on them, a proof that this acid is a supporter of combustion.

The simple incombustibles have no action on it. It oxidizes several of the metals, especially when assisted by heat.

It combines with the salifiable bases, and forms a class of salts called *arseniates.*

It has no action on any of the acids already described.

Composition.

From the analysis of Proust, it appears that this acid is composed of

65 arsenic.
35 oxygen.
100

Sect. IV. *Tungstic Acid.*

Tungstic acid.

The substance originally called tungstic acid, was discovered by Scheele. It was not pure, being contaminated by the acid employed in separating it.

The real tungstic acid is a yellow powder, first described by the Eluyarts. It is tasteless, insoluble in water, and has no effect on vegetable blues. It is rather an oxide than an acid. But it combines with the salifiable bases, and forms a class of salts called *tungstates*.

Sect. V. *Of Molybdic Acid.*

Molybdic acid.

This acid was discovered by Scheele. It has been lately examined by Bucholz.

How obtained.

It may be obtained by digesting nitric acid on molybdena, till the whole is converted into a white mass. Edulcorate this mass with water, the residue is molybdic acid.

It is a white powder of the specific gravity 3.460. In close vessels it melts and crystallizes when heated; but in open vessels it sublimes, and may be collected in the form of brilliant yellow scales.

Its properties.

It is soluble in 960 parts of water. The solution is pale yellow. It is tasteless, but reddens vegetable blues.

Molybdic acid is not affected by oxygen gas; but it is decomposed by sulphur and charcoal, and several of the metals.

It combines with the salifiable bases, and forms a class of salts called *molybdates*.

It dissolves in sulphuric acid. The solution is colourless when hot, but becomes blue when cold. It dissolves also in muriatic acid, but not in nitric acid.

Composition.

According to the analysis of Bucholz, it is composed of

67 molybdenum.
33 oxygen.
———
100

Sect. VI. *Of Chromic Acid.*

Chromic acid.

This acid was discovered by Vauquelin. It may be obtained from the *red lead ore* of Siberia, by boiling the ore with carbonate of soda, decanting off the fluid solution, and saturating it with sulphuric acid. A red powder falls, which is *chromic acid*.

How obtained.

Its properties.

It has a red or orange yellow colour, an acrid and metallic taste; is soluble in water, and crystallizes in elongated prisms of a ruby colour.

When heated it gives out oxygen gas, and is converted into green oxide of chromium.

When mixed with filings of tin and muriatic acid, it becomes at first yellowish brown, and afterwards assumes a beautiful green colour. When treated with acids, and various other combustibles, a green colour is also evolved.

Sect. VII. *Of Columbic Acid.*

Columbic acid.

This acid was discovered by Hatchet in an ore from America of a black colour, which he found in the British Museum. It was obtained by fusing the ore with potash, dissolving the potash in water, and adding nitric acid to the solution. The columbic acid precipitated in flakes.

How obtained.

Its properties.

It is a powder of a white colour, and not very heavy. It is tasteless, insoluble in water, but gives a red colour to vegetable blues.

Sulphuric acid dissolves it, and forms a colourless solution, from which the columbic acid is precipitated by water. It is soluble also in muriatic acid, but not in nitric acid.

It combines with the salifiable bases, and forms a class of salts called *columbates*.

Class III. *Combustible Acids.*

Combustible acids.

The acids belonging to this class may be distinguished by the following properties.

Their properties.

1. If they be combined with potash, and distilled, they are decomposed, charcoal is usually evolved, and a considerable quantity of heavy inflammable air extricated.

2. All of them contain at least two simple combustibles as a base, namely *carbon* and *hydrogen*. Some of them also contain *azote*. Oxygen usually enters into their composition, though not perhaps always.

3. They do not seem capable of combining with different doses of oxygen. Whenever the proportion of oxygen changes, that of the other constituents varies also.

4. They are decomposed by the action of the more powerful acid supporters, and either converted into other combustible acids, or into oxide and acid products.

They may be divided into four orders. Those belonging to the first crystallize, and may be volatilized without decomposition. Those belonging to the second likewise crystallize, but they cannot be volatilized without decomposition. Those belonging to the third order are not crystallizable, though they may be exhibited in the state of a dry mass. Under the fourth order are placed three acids, which, from the singularity of their properties, ought to be considered apart.

The following Table exhibits the names and component parts of each of these acids, as far as is known at present.

Order I. *Crystallizable, volatilizable.*

Names.	Constituents.
1. Acetic.	Carbon, hydrogen, oxygen.
2. Benzoic.	
3. Sebacic.	
4. Succinic.	
5. Moroxylic.	
6. Camphoric.	
7. Oxalic?	

ORDER II. *Crystallizable, not volatilizable.*

Names.	Constituents.
1. Mellitic.	Carbon, hydrogen, oxygen.
2. Tartaric.	
3. Citric.	
4. Kinic.	
5. Saclactic.	
6. Uric.	Carbon, hydrogen, azote, oxygen.

ORDER III. *Not crystallizable.*

1. Malic.	Carbon, hydrogen, oxygen.
2. Suberic.	
3. Formic.	

ORDER IV. *Colorific.*

1. Prussic.	Carbon, hydrogen, azote.
2. Gallic.	Carbon, hydrogen, oxygen.
3. Tannin.	

SECT. I. *Of Acetic Acid.*

Acetic acid.

How obtained.

This has been the longest known of all the acids. It is obtained by causing *wine* or *beer* to undergo a new fermentation. They become sour, and are known by the name of *vinegar*. When the vinegar is distilled, a transparent colourless liquid is obtained, called *distilled vinegar*, or sometimes *acetous acid*. When this substance is combined with oxide of copper, and the dry mass distilled, a liquid is obtained, which contains the acid in a much more concentrated state. It was formerly called *radical vinegar*, and *acetic acid*, by way of eminence.

It is now known that the acid principle in all these three liquids is precisely the same, and that they differ merely in the concentration of that acid, or in consequence of containing small quantities of some foreign ingredient. Hence, the term *acetic acid* is now applied to the acid in all cases.

Its properties.

Acetic acid is a liquid, transparent and colourless like water. It has a peculiar and well known aromatic smell, when in the state of vinegar or distilled vinegar. In radical vinegar this smell is not so agreeable, being mixed with a kind of empyreumatic odour. When sufficiently concentrated, it may be obtained in crystals; but the process is difficult, and requires particular precautions to ensure success.

The specific gravity of distilled vinegar varies from 1.007 to 1.0095: that of radical vinegar is 1.080. But the strength of the acid is not always proportional to its specific gravity, owing to the presence of foreign bodies, from which it is very difficult to free it. It is very volatile, unites with water in any proportion, and reddens vegetable blues.

Neither oxygen, the simple combustibles, or incombustibles, have any action on this acid. It oxidizes some metals; but its action on these bodies is not violent. It combines with metallic oxides, and forms with every one a soluble salt. Indeed all the salts that contain acetic acid are soluble in water. In this respect it agrees with nitric acid.

It combines with salifiable bases, and forms a class of salts called *acetates*.

Sulphuric and nitric acids seem capable of decomposing it, but the action of the other acids is not remarkable. It dissolves and combines with many vegetable bodies, and is, in consequence, useful in vegetable analysis.

Composition.

It is composed of oxygen, hydrogen, and carbon, according to the experiments of Thenard and Gay-Lussac, in the following proportions:

Oxygen,	44.147
Hydrogen,	5.629
Carbon,	50.224
	100

SECT. II. *Of Benzoic Acid.*

Benzoic acid.

This acid is obtained, by sublimation, from a resinous substance called benzoin.

Its properties.

It is a fine light white matter in small needles. It is not brittle, but has a kind of ductility. Its taste is acrid, hot, and somewhat bitter. Its odour is weak but aromatic. Its specific gravity is 0.667. It reddens the most delicate vegetable blues.

It is easily volatilized by heat. It burns when kindled, and leaves no residuum. It is not altered by exposure to the air. Cold water dissolves no sensible quantity of it, but it dissolves readily in hot water.

It is not acted upon by oxygen gas, or by any of the simple combustibles or incombustibles; nor does it seem capable of oxidizing any of the metals.

It combines with the salifiable bases, and forms a class of salts called *benzoates*.

Several of the strong acids dissolve it; but it is precipitated again unaltered by the infusion of water. Alcohol dissolves it copiously.

SECT. III. *Of Sebacic Acid.*

Sebacic acid.

This acid was mentioned many years ago, but its nature and properties remained unknown till it was lately examined by Thenard. Berzelius has lately added considerably to our knowledge of it. It may be prepared by the following process.

How prepared.

Distil hog's lard; wash the product with hot water, separate this water and drop into it acetate of lead. A flaky precipitate appears which is to be washed and dried, mixed with sulphuric acid and heated. A melted substance, like fat, swims on the surface. This substance is sebacic acid.

Its properties.

Sebacic acid is white; it has no smell; its taste is a pleasant sour, leaving in the mouth a very slight impression of bitterness. It reddens vegetable blues. When heated, it melts like tallow, and, on cooling, concretes into a crystallized mass. It may be volatilized, but requires a higher temperature than benzoic acid. Berzelius has shown that this acid, in most of its properties, coincides with benzoic acid; and that the two acids, if not absolutely the same, at least approach very closely to each other.

Sect. IV. *Of Succinic Acid.*

Succinic acid.
How obtained.

This acid is obtained when amber is exposed to heat. It sublimes in small needles, coloured by an oil, from which it may be freed by digestion in nitric acid and subsequent crystallization. Trommsdorf affirms, that when dry saclactic acid is distilled, it yields abundance of succinic acid.

Its properties.

This acid is white, crystallizes in triangular prisms, has an acid taste, and reddens vegetable blues. When heated, it melts and then sublimes.

It is but little soluble in cold, but very soluble in hot water. Alcohol acts nearly upon it as water. It dissolves in sulphuric, nitric, and muriatic acids, without undergoing decomposition.

It combines with the salifiable bases, and forms a class of salts called *succinates*.

Sect. V. *Of Moroxylic Acid.*

Moroxylic acid.

This acid was discovered by Klaproth in a saline exudation incrusting the bark of the white mulberry tree. This salt was a compound of the acid in question and lime.

How obtained.

The acid was separated by dissolving the salt in water, and precipitating the acid by means of acetate of lead. The precipitate was mixed with diluted sulphuric acid and digested. Sulphate of lead was formed, and moroxylic acid disengaged.

Its properties.

It crystallized in needles, which had the taste of succinic acid, were not altered by exposure to the air, and dissolved readily in water and in alcohol. When heated it sublimes, and thus may be obtained quite pure.

Sect. VI. *Of Camphoric Acid.*

Camphoric acid.

This acid was discovered by Kozegarten, but first accurately described by Bouillon La Grange.

How obtained.

It is obtained by distilling a solution of camphor in nitric acid, repeatedly adding nitric acid till it amounts to 24 times the weight of the camphor. Crystals gradually make their appearance, which consist of *camphoric acid*.

Its properties.

This acid is snow-white. Its crystals are parallelopipeds which effloresce in the air. Its taste is acid and bitter, it has the smell of saffron, and reddens vegetable blues.

It dissolves in about 100 parts of cold water, but is more soluble in hot water. It dissolves in alcohol. The salts which it forms are called *camphorates*.

Sect. VII. *Of Oxalic Acid.*

Oxalic acid.
How obtained.

This acid was discovered by Scheele, and first described by Bergman. It is obtained by heating a solution of sugar in nitric acid.

Its properties.

It crystallizes in small four-sided prisms, terminated by dihedral summits. These crystals are composed of 77 parts acid, and 23 water. When exposed to heat, it sublimes, but at the same time is partly decomposed.

These crystals have a very acid taste, and redden vegetable blues. They dissolve in their own weight of boiling water, and in twice their weight of cold water. They dissolve, also, readily in alcohol.

When exposed to dry air, they effloresce; but in moist air, they are not altered. Neither oxygen, nor the simple combustibles or incombustibles act on this acid. It oxidizes some of the metals; but most of them are not affected by it.

It combines with the salifiable bases, and forms a class of salts called *oxalates*.

Muriatic and acetic acids dissolve it; sulphuric acid decomposes it, by the assistance of heat. Nitric acid converts it into water and carbonic acid.

Composition, according to Dr Thomson.

When combined with a base and distilled, it is decomposed, and converted into *water*, *carbonic acid*, *carbonic oxide*, *carbureted hydrogen*, and *charcoal*. It is composed, according to the experiments of Dr Thomson, of

oxygen,	64
carbon,	32
hydrogen,	4
	100

According to Thenard and Gay-Lussac.

Thenard and Gay-Lussac make its constituents as follows:

oxygen,	70.689
carbon,	26.566
hydrogen,	2.745
	100

Sect. VIII. *Of Mellitic Acid.*

Mellitic acid.

This acid was discovered by Klaproth, in the mineral called *mellite* or *honeystone*, which he found composed of alumina and the acid in question.

How obtained.

It is obtained by boiling the mineral powder in 72 times its weight of water, filtering the liquid, and evaporating sufficiently. The mellitic acid crystallizes.

Its properties.

The crystals are needles, having a brownish colour, and a sweetish sour taste. It is but moderately soluble in water. Nitric acid does not seem to decompose it. It reddens vegetable blues. The salts which it forms are called *mellates*.

Sect. IX. *Of Tartaric Acid.*

Tartaric acid.

This acid exists in the salt called *tartar*, from which it was first obtained in a separate state by Scheele. The process is this:

How obtained.

Dissolve tartar in water, and add chalk in powder as long as an effervescence continues. A white powder precipitates. Pour on this precipitate a quantity of sulphuric acid equal in weight to the chalk employed, previously diluted with water, and digest for a day or two. Then filter and evaporate the liquid. The tartaric acid is obtained in crystals.

These crystals are white, transparent, and hard. They are very irregular four-sided prisms, composed of 84.5 real acid, and 15.5 water.

Its properties.

It is not altered by exposure to the air. At 212°, it melts and becomes as liquid as water. At 250°, it boils without losing its transparency or acquiring colour. When cooled, it concretes into a hard mass, but the nature of the acid is changed. It has now acquired the property of deliquescing when exposed to the air. When distilled, this acid yields an acid liquid formerly called pyrotartarous acid, but now known to be the acetic disguised by means of an empyreumatic oil. When combined with a base and distilled, tartaric acid is decomposed, and converted into *water*, *carbonic acid*, *heavy inflammable air*, and *charcoal*.

It dissolves readily in water, and when the solution is diluted, the acid undergoes spontaneous decomposition.

None of the simple substances produce any striking effect upon this acid. It combines with the salifiable bases, and forms a class of salts called *tartrates*.

Composition.

According to Thenard and Gay-Lussac, it is composed of

Oxygen,	69.321
Carbon,	24.050
Hydrogen,	6.629
	100

SECT. X. *Of Citric Acid.*

Citric acid.

This acid exists in the juice of oranges and lemons, and was first obtained pure by Scheele. His process was this:

How obtained.

Saturate lemon-juice with chalk. A precipitate falls. Wash this precipitate, and pour on it as much sulphuric acid as will saturate the chalk employed, previously diluted with six times its weight of water. Digest, filter, and evaporate the liquid. The citric acid crystallizes.

Its properties.

This acid crystallizes in rhomboidal prisms. The crystals are not altered by exposure to the air. The taste is acid, and vegetable blues are reddened by it. It dissolves in less than its weight of water.

It is not acted on by the simple substances. It oxidizes a few of the metals. It combines with the salifiable bases, and forms a class of salts called *citrates*.

Sulphuric acid decomposes it. Nitric acid converts it into oxalic acid, or into acetic acid, if used in excess.

Composition.

Its constituents, according to Thenard and Gay-Lussac, are as follows:

Oxygen,	59.859
Carbon,	33.811
Hydrogen,	6.330
	100

SECT. XI. *Of Kinic Acid.*

Kinic acid.

This acid was discovered by Vauquelin, in a salt first obtained from *Jesuits bark*, by Deschamps. This salt is a compound of kinic acid and lime.

How obtained.

Vauquelin dissolved the salt in water, and precipitated the lime by means of oxalic acid. The liquid was evaporated to the consistence of a syrup, and then set aside. No crystals formed in it at first, but on being touched, it wholly crystallized in diverging plates.

Its properties.

Its colour is somewhat brown, its taste very acid and bitter. It was not altered by exposure to the air. It is very soluble in water. It does not precipitate silver nor lead from their solutions. When heated, it is decomposed, and charcoal remains behind.

SECT. XII. *Of Saclactic Acid.*

Saclactic acid.

How obtained.

This acid was discovered by Scheele, who formed it by digesting sugar of milk in nitric acid. Fourcroy and Vauquelin ascertained, afterwards, that it is formed when gum is heated with nitric acid and the solution allowed to cool. A white powder precipitates, which is the acid in question.

Its properties.

Saclactic acid, thus obtained, is in the form of a white gritty powder, with a slight acid taste. It is only slightly soluble in boiling water. The solution has an acid taste, and reddens vegetable blues.

The compounds which this acid forms with the salifiable bases, are called *saccolates*.

Composition.

The constituents, according to Thenard and Gay-Lussac, are as follows:

Oxygen,	62.69
Carbon,	33.69
Hydrogen,	3.62
	100

SECT. XIII. *Of Uric Acid.*

Uric acid.

This acid was discovered by Scheele in urinary calculi, and first called *lithic acid*. But this term was afterwards laid aside, and *uric acid* substituted; because this acid constitutes one of the ingredients of urine. For the best account of the properties of this acid, we are indebted to Dr Henry.

How obtained.

It is obtained by dissolving the calculi, composed chiefly of it, in alkaline ley, and precipitating by means of muriatic or acetic acids. The white powder which falls, when well edulcorated, is pure uric acid.

Its properties.

It is a white powder, without taste or smell. It reddens vegetable blues, and requires more than 1700 parts of cold water to dissolve it.

It dissolves readily in fixed alkaline solutions, but not in alkaline carbonates. It dissolves in nitric acid; and when the solution is evaporated nearly to dryness, it assumes a fine pink colour, which becomes much deeper when water is added, so as to have a near resemblance to carmine. The watery solution of this matter loses its red colour in a few hours, and it cannot afterwards be restored.

Oxymuriatic acid readily converts the uric into the oxalic acid.

When distilled, carbonate of ammonia is obtained, and a saline sublimate, which Dr Henry has shown to be a compound of ammonia with a peculiar acid.

SECT. XIV. *Of Malic Acid.*

Malic acid.

This acid was discovered by Scheele. It exists in apples, and in a variety of vegetable substances. It is formed also by the action of nitric acid on sugar.

How obtained.

Scheele obtained it by saturating the juice of apples with potash, precipitating by acetite of lead, digesting the precipitate in a sufficient quantity of sulphuric acid to separate the lead, and then filtrating. The liquid contained pure malic acid.

When malic acid is obtained by the action of nitric acid on sugar, it is colourless; but it very easily acquires a brown colour by the action of heat, or even by keeping it in a liquid state. When evaporated, it may be obtained in a solid state; but it is not capable of crystallizing.

Its properties.

Its taste is very acid, and it dissolves readily in water. It is said to undergo spontaneous decomposition; but we have kept it more than two years in a liquid state without observing any such change. It bears a strong resemblance to the citric acid, but it does not crystallize; forms a more soluble salt with lime; and precipitates mercury, lead, and silver, from nitric acid, which citric acid does not.

The compounds which it forms with the salifiable bases, are called *malates*.

SECT. XV. *Of Suberic Acid.*

Suberic acid.

This acid was obtained by Brugnatelli by digesting common cork in nitric acid. Its properties were afterwards more investigated by Bouillon La Grange.

Its properties.

It does not crystallize, but may be obtained in powder or in pellicles. Its taste is acrid and slightly bitter; it reddens vegetable blues, attracts moisture when exposed to the air, but is not very soluble in water. It may be sublimed without decomposition. The other acids dissolve it incompletely. The salts which it forms are called *suberates*.

SECT. XVI. *Of Formic Acid.*

Formic acid.

This acid exists in the *formica rufa*, or *red ant*. It was noticed in a paper by Mr Ray in 1671, in consequence of the observations of Halse and Fisher. But its properties were first investigated by Margraff. Fourcroy and Vauquelin endeavoured to prove that it was a mixture of *acetic* and *malic acids*; but the experiments of Suersen have shewn that this opinion is not correct.

How obtained.

This acid may be obtained by infusing the ants in water, distilling off the water as long as it comes over without any burnt smell, saturating the water with potash, evaporating to dryness, mixing the residue with as much diluted sulphuric acid as is sufficient to saturate the potash employed, distilling this mixture to dryness, rectifying the liquid that comes over by a second distillation with a moderate heat. The liquid now contains only pure formic acid.

Its properties.

This liquid is colourless like water. It has a peculiar smell; it reddens vegetable blues, and has an acid taste. Its specific gravity varies from 1.102 to 1.113, whereas the most concentrated acetic acid is only 1.080 Notwithstanding this superior weight, it is not capable of neutralizing so much of the salifiable bases as acetic acid. Lowitz attempted, in vain, to procure this acid in crystals, though he succeeded easily with acetic acid. The compounds which it forms with the different bases are called *formates*. There is a striking analogy between them and the *acetates*.

CHAP. VI.

Of Colorific Acids.

Colorific acids.

UNDER this name we include three substances, which possess such peculiar properties that they ought to be considered separately from the combustible acids. These are *prussic acid*, *gallic acid*, and *tannin*. The two first have always been considered as acids. The last, though not acid, is so intimately connected with the gallic, that they cannot well be separated. These substances possess the following characters.

1. They unite with alkaline bodies, but do not seem capable of neutralizing them.

2. They act with great energy upon metallic solutions, usually entering into combination with the oxide, and precipitating it in the state of an insoluble powder.

3. They have a tendency to enter into triple compounds with a variety of bodies, especially with metallic oxides and alkalies.

SECT. I. *Of Prussic Acid.*

Prussic acid.

This important substance was accidentally discovered by a chemist of Berlin in 1710. This chemist, Diesbach by name, found out the method of preparing *Prussian blue*. The nature of this pigment was examined by Brown. But it was Macquer who first ascertained its nature in a satisfactory manner. In consequence of his experiments, Prussian blue was considered as a compound of oxide of iron, with a peculiar acid. But no one was able to obtain this acid in a separate state, or to ascertain its properties, till Scheele, in two admirable dissertations published in 1782 and 1783, pointed out a method of procuring it, and gave a detailed account of its nature.

How obtained.

He procured the Prussic acid in the following manner: He boiled in a matrass a mixture of 10 parts Prussian blue, 5 parts red oxide of mercury, and 30 parts of water, and filtered the solution. The liquid was poured upon 2¼ parts of clean iron filings, and at the same time 1 part of sulphuric acid was added, and the mixture shaken. The iron disappeared, and a quantity of running mercury was precipitated in its place. Distil off one-fourth of this liquid by a moderate heat, what comes over consists of water holding prussic acid in solution.

Its properties.

Prussic acid, thus obtained, is a colourless liquid like water. It has a strong odour, resembling that of the flowers of the peach or of bitter almonds. Its taste is sweetish, acrid, and hot, and it is apt to excite cough. It does not alter the colour of vegetable blues. When swallowed, it proves a very virulent poison.

How obtained pure.

In this state it is combined with water; but Gay-Lussac obtained it pure by the following process: He put into a tubulated retort a quantity of prussiate of potash, and poured over it weakly fuming muriatic acid. The retort was luted to a flask containing a mixture of chalk and muriate of lime in powder. This flask communicated with a second containing muriate of lime, and this with a third empty. The flasks were surrounded with a mixture of two parts snow, and one part salt. A gentle heat being applied to the retort, the prussic acid passed over, and swam above the muriate of lime. By gently heating the first flask, the acid is made to pass into the second flask, and by this means is rectified.

Its properties.

Prussic acid, thus obtained, is a limpid and colourless liquid. It is extremely volatile and pungent; boiling at the temperature of 80°, and at the temperature of 50° it supports a column of mercury rather more than ten inches high. At 68° it quintuples the bulk of any gas with which it is mixed. It freezes at 2°. In consequence of this extreme volatility and easy congelation, a curious phenomenon takes place. If a drop of it be let fall upon a sheet of paper, it immediately freezes, in consequence of rapid evaporation. The specific gravity of this liquid is 0.70583 at the temperature of 44.5°. It reddens vegetable blues.

It is capable, when dry, of withstanding a red heat without decomposition; but when water is present, it very readily undergoes change.

It combines with the salifiable bases, and forms a class of bodies called *prussiates*. But they have very little permanency, being decomposed by all other acids, and even by exposure to the atmosphere.

It is also capable of forming triple compounds, in which it is combined with two bases at once, one of them an alkali or earth, the other a metallic oxide. These compounds are much more permanent, and are therefore usually employed by chemists. The one in most frequent use is the *triple prussiate of potash*, a yellow coloured salt crystallizing in cubes, and composed of prussic acid, potash, and oxide of iron.

Scheele's method of forming Prussic acid.

Scheele succeeded in forming prussic acid, by causing a current of ammoniacal gas to pass through red hot charcoal; and the experiment has been since repeated successfully by others. Hence it is obvious, that this acid is composed of the constituents of ammonia and charcoal united together, or of hydrogen, azote, and carbon. This has been further confirmed by Berthollet. Chlorine has the property of altering the nature of prussic acid, and renders it capable of throwing down iron from solutions *green* instead of blue. To the acid thus altered, Berthollet gave the name of *oxyprussic acid*. When heat is applied to it, the whole is converted into carbonate of ammonia.

Prussian blue.

Prussian blue may be formed, by calcining a mixture of potash and dried blood in a covered crucible, in a heat gradually raised to redness. The mass is dissolved in water, and poured into a solution of sulphate of iron. A green coloured precipitate falls, which becomes prussian blue when digested in muriatic acid. The triple prussiate of potash was formerly called phlogisticated alkali. It is still useful in detecting different metals in solutions, by the colour of the precipitate which it occasions, especially iron, which it throws down of a deep blue.

SECT. II. *Of Gallic Acid.*

Gallic acid.

This acid forms one of the constituents of the substance called *nutgalls*, a concretion formed on the oak in consequence of the puncture of insects. Nutgalls come to this country chiefly from the Levant. They vary a good deal in their appearance. Scheele first separated gallic acid from nutgalls.

How obtained.

An infusion of nutgalls left to itself for some time, becomes mouldy on the surface, and lets fall small crystals. These crystals being picked out, dissolved in water, and obtained again by evaporation, constitute *gallic acid*.

The acid obtained by this process is never quite pure. If the infusion of nutgalls be evaporated to dryness, and the powdered residue be digested in pure alcohol, the alcohol, when cautiously distilled to one-eighth, leaves a residue behind it nearly colourless, which is soluble in water, and yields by evaporation gallic acid in needles, much lighter coloured and purer than that obtained by the first described process.

Its properties.

Gallic acid is white, usually with a shade of brown or yellow. It is crystallized in needles or transparent plates. Its taste is acid, and somewhat astringent; and when heated, it exhales a peculiar and rather unpleasant aromatic odour. It is soluble in 1½ parts of boiling, and in 12 parts of cold water. When the solution is heated, the acid is decomposed. When long kept, it becomes darker coloured, and the acid is likewise altered in its properties.

When heated, it sublimes, but its properties are somewhat altered. When distilled, it yields, like other vegetable acids, carbonic acid gas, and heavy inflammable air. Water is also formed, and a portion of the acid escapes, slightly modified in its nature.

It is not altered by exposure to the air. Neither oxygen gas, the simple combustibles, or incombustibles, seem to produce any effect upon it. The action of the metals is unknown.

Gallates.

The compounds of this acid, with the salifiable bases, are called *gallates*. They have scarcely been examined. When gallic acid is dropt into lime, barytes, or strontian water, it strikes a bluish red colour, and occasions a flaky precipitate. It occasions a precipitate likewise when poured into the solutions of yttria, glucina, or zirconia in acids. Upon metallic solutions it acts with considerable energy, changing their colour, and occasioning precipitates in many of them. Thus, with iron it strikes a dark blue, or almost black colour. When it precipitates metallic oxides, it seems to bring them nearer to the metallic state, and sometimes reduces them altogether. Thus gold is precipitated by it in the metallic state.

SECT. III. *Of Tannin.*

Tannin.

Nutgalls, besides gallic acid, contain several constituents; one of the most curious and important of these is tannin, which is to occupy our attention in this Section.

Tannin was first pointed out in vegetables by Deyeux, though some of its properties had been noticed long before by Lewis. Seguin first pointed out its great importance in tanning, and hence the name was given it, by which it is at present known. Proust endeavoured to obtain it in a separate state. Mr Davy added to our knowledge of its properties. But it is to Mr Hatchett that we are indebted for the most important set of new facts. He pointed out a method of making it artificially from almost all animal and vegetable substances. As Mr Hatchett's tannin differs in several respects from the tannin of nutgalls and other astringent substances, it will be proper to divide this section into two parts.

1. *Natural Tannin.*

Natural Tannin.

No unexceptionable method of obtaining tannin from nutgalls, in a state of complete purity, has yet been discovered. The best method is this:

How obtained.

Make an infusion of nutgalls in water, evaporate the infusion to dryness, pulverize the residuum, and digest the powder in repeated portions of pure alcohol till that liquid ceases to dissolve any thing. The residue is tannin tolerably pure. It may be dissolved in water, and precipitated by acetate of lead. The edulcorated precipitate being mixed with water, and a current of sulphureted hydrogen passed through it, the lead combines with sulphur and remains insoluble; while the tannin, thus set at liberty, dissolves in the water, and may be obtained by evaporating the liquid.

Its properties.

Tannin, thus obtained, is a brittle substance of a brown colour, with an astringent taste like that of nutgalls. It dissolves readily in water, and the solution, according to Trommsdorf, is not liable to become mouldy. Pure alcohol does not dissolve it; but it is soluble in alcohol diluted with a little water, as for example in alcohol of 0.818 of specific gravity, which contains $\frac{1}{10}$th of its weight of water.

It seems capable of combining with oxygen, but its properties are, by that means, completely altered; being, according to Proust, a species of *extractive*.

The action of the simple combustibles on tannin is unknown. The action of the metals is probably small, but it combines with most of the metallic oxides, and forms compounds which, for the most part, are insoluble in water. Thus it strikes a deep blue or black with solutions of iron, and if the solutions be diluted, the compound of tannin and the oxide of iron precipitates.

When a solution of *glue*, or *gelatine* as chemists term it, is poured into an aqueous solution, a precipitate immediately falls. This precipitate consists of tannin and gelatine combined together. It is insoluble in water, and composed, according to Davy, of 54 gelatine and 46 tannin. This property renders gelatine a very delicate test of tannin, which it detects when it exists, even in small proportion, in vegetable liquids.

The alkalies combine with tannin, and prevent it from precipitating gelatine, till they are saturated with an acid.

The earths combine with tannin, and form with it compounds nearly insoluble. Hence they precipitate it from the infusion of nutgalls.

Most of the acids combine with tannin, and form soluble compounds with it. Arsenic, muriatic, and sulphuric acids precipitate it from water. The sulphuric acid gradually decomposes it. Nitric acid also decomposes it, and a substance is formed having the properties of malic acid.

Such are the properties of the tannin of nutgalls, as far as they have been ascertained. The difficulty of obtaining it in a state of purity renders some of them ambiguous, and has induced chemists to employ the infusion of nutgalls in their experiments rather than tannin.

Writing ink.

This infusion is employed in considerable quantity by dyers, and it forms the principal ingredient of common *writing ink*. This liquor consists of a solution of sulphate of iron in the infusion of nutgalls. No other salt of iron tried answers so well as the sulphate. The deepest black is formed when equal weights of nutgalls and of sulphate of iron are employed. But it is not permanent unless the nutgalls amount to about thrice the weight of the sulphate. The best ink, according to Dr Lewis, who made many experiments on the subject, may be made by means of the following formula.

Logwood, ...	1 ounce.
Nutgalls, in powder,	3
Green vitriol, ...	1
Water, ...	1 or 2 quarts.

Boil the logwood and the nutgalls in water, adding new liquid in proportion to the evaporation, then strain through a cloth and dissolve the green vitriol, adding at the same time one ounce of gum arabic and a little sugar. Some recommend the addition of a little cloves to prevent the ink from moulding.

Tannin exists in many other substances besides nutgalls. The barks of many trees, the substances called catechu and kino, logwood, brazil wood, fustick, and many other vegetable bodies yield it in abundance. From the experiments of Proust, it appears that it varies in its qualities in these bodies, or that there are different species of tannin varying from each other in several respects, especially in the colour which they strike with iron. Some precipitate that metal black, some green, and some flesh-red.

2. *Artificial Tannin.*

Artificial Tannin.

The important discovery, that a substance capable of tanning leather like the tannin of nut-galls, may be formed artificially, was made by Mr Hatchett in the course of a set of experiments on the slow carbonization of vegetable bodies, and detailed by him in various papers read to the Royal Society in 1805.

How obtained.

To form it, we have only to digest diluted nitric acid on charcoal, till the whole, or nearly the whole, is dissolved, and evaporate the solution to dryness; a brown coloured matter remains, which is *artificial tannin*. 100 grains of charcoal, by this process, were converted into 120 grains of artificial tannin. A part of this increase is moisture, and it is very difficult to get red of the whole of the nitric acid, a portion of which adheres to the tannin with great obstinacy.

Its properties.

Tannin, thus prepared, is a substance of a brown colour, it has considerable lustre, and breaks with a vitreous fracture. Its taste is very bitter and highly astringent. It has no smell. It dissolves readily in cold water, forming a brown coloured solution. Alcohol, of the specific gravity 0.800, also dissolves it.

The solution is precipitated by gelatine very readily. The precipitate is brown, and composed, according to Hatchett, of 36 tannin and 64 gelatine.

Sulphuric and muriatic acids form a precipitate when poured into solutions of artificial tannin. Nitric acid does not decompose it nor alter its properties. This forms a marked distinction between natural and artificial tannin.

The alkalies unite with it, and prevent it from precipitating gelatine till they are saturated. The alkaline earths, and most of the metallic oxides, form insoluble compounds with it. Hence it precipitates most of these bodies from their solutions.

When distilled, artificial tannin yields water, a little nitric acid, and a yellow coloured liquid; on raising the fire, ammoniacal gas is disengaged with great rapidity; this is followed by carbonic acid gas, and a gas possessing the properties of azote. A bulky charcoal remains behind. From these results it is obvious that this substance consists of oxygen, azote, hydrogen, and carbon. The last constituent, no doubt, predominates.

Charcoal yields artificial tannin.

Mr Hatchett has shewn that every charcoal, both from animal and vegetable substances, provided it be in the state of charcoal, yields artificial tannin when digested with nitric acid. He has pointed out two other methods of procuring a substance possessed of similar properties. The first is by dissolving indigo and the resins, or gum resins, in nitric acid, and digesting them for a considerable time in that liquid. When the solution is evaporated to dryness, a yellow coloured matter remains, which possesses the properties of artificial tannin. The second method is by dissolving camphor and the resins in sulphuric acid, digesting till the solution becomes black, and then precipitating by pouring it into cold water. If the black powder which falls be digested in alcohol, a brown matter is taken up which possesses many of the properties of artificial tannin.

Such are the properties of the colorific acids. They act with most energy on metallic solutions, forming precipitates which vary in their colour according to the metal. It is this property which renders them of so much importance in a chemical point of view. The following Table exhibits a view of the colours which these bodies strike with the different metals, as far as is known.

Table of the colours which colorific acids strike with the metals.

Metals.	*Prussiate of Potash.*	*Gallic Acid.*	*Infusion of Nut-galls.*	*Artificial Tannin.*
Gold	Yellowish white	Reduced	Reduced	Reduced
Platinum	0	0	0	
Silver	White	Yellowish brown	Yellowish brown	Yellow
Mercury	White	Orange yellow	Orange yellow	Yellow
Palladium	Olive			
Rhodium	0			
Iridium	0 Becomes colourless		0 Becomes colourless	
Osmium			Blue	
Copper	Greenish yellow	Brown	0 Becomes olive	Olive
Iron	Blue	Black	Black	Brown
Nickel	Green	White	Grey	
Tin	White		Brown	Blackish grey
Lead	White	White	White	Brown
Zinc	White	0	0	0
Bismuth	White	Orange	Orange	
Antimony	0	White	White	Yellow
Tellurium	0		Yellow	
Arsenic	White	0	0	Yellow ?
Cobalt	Brown yellow	0	Yellow white	
Manganese	Yellow white	0		
Chromium	Green		Brown	
Molybdenum				
Uranium	Brown red		Chocolate	
Tungsten	Brown		Straw yellow	
Titanium	Yellowish brown		Blood red	
Columbium	Olive		Orange	
Cerium	White	0	0	

CHAP. VII.

Of the Compounds of Chlorine.

Compounds of chlorine,

We shall in this Chapter give an account of the compounds which chlorine forms with all the other simple substances, as far as the subject has been investigated. For all the experiments hitherto made on the subject, we are indebted to Mr Davy, and his brother, Mr John Davy.

With oxygen.

1. Chlorine has the property of combining with oxygen. The compound is a gas of a yellow colour, which may be obtained by pouring diluted muriatic acid on the salt called hyperoxymuriate of potash, and applying a moderate heat. The gas may be received over mercury. It was discovered, and its properties investigated, by Mr Davy, who has given it the name of *euchloric* gas. Its colour is greenish yellow, and very intense. Water absorbs about ten

times its bulk of it. Its specific gravity is 2.61. It is composed of two parts in volume of chloric gas, and one of oxygen gas. When heated, it is decomposed, and light and heat are produced.

With hydrogen.

2. Chlorine combines very readily with hydrogen, and forms the very important compound called *muriatic acid*. When the gases, each as dry as possible, are mixed together in equal bulks, and the mixture exposed to the light of the sun, inflammation takes place, the two gases disappear, and a quantity of muriatic acid gas is formed nearly equal to them in bulk. Now, as the specific gravity of muriatic acid gas is almost exactly the mean of the specific gravity of hydrogen and chloric gas, it is inferred that it is a compound of equal bulks of these gases. Therefore muriatic acid is composed by weight of

97.24 chlorine,
2.76 hydrogen,

100.00

or of one part of hydrogen and about 35 of chlorine. But if we suppose, with Mr Davy, that the proportion of hydrogen exceeds that of chloric gas in bulk, we may consider muriatic acid as composed of one part hydrogen, and 33 of chlorine.

Muriatic acid may be obtained by putting some common salt in a small glass retort, pouring over it sulphuric acid, and receiving the product over mercury.

Muriatic acid gas is invisible, and possesses the mechanical properties of common air. Its specific gravity is 1.278, that of air being 1.000. Its smell is pungent and peculiar, and when mixed with air it forms a visible smoke, owing to its great avidity for moisture.

It does not support combustion, nor can it be breathed by animals. When a lighted taper is plunged into it, it goes out with a green coloured flame.

Water, when brought into contact with this gas, absorbs it with great rapidity, and the whole disappears. Water absorbs 515 times its bulk of this gas, and six cubic inches of water by this absorption are converted into nine. The affinity between this gas and water are very great.

Water saturated with this gas is known by the name of *liquid muriatic acid*. It has been long known, and is very much employed by chemists. When pure, it is transparent and colourless: but it very often has a greenish yellow colour, owing to the presence of iron or of some other impurity. It has the smell of muriatic acid gas, and smokes when exposed to the air. Its specific gravity is never greater than 1.203, and seldom exceeds 1.196; and when strongest, never contains more than one-fourth of its weight of acid: the rest is water.

The following Table gives us the strength and boiling point of muriatic acid of various densities. It is from the experiments of Kirwan and Dalton.

Specific gravity of acid.	Real acid per cent. by weight.	Boiling point.
1.199	25.6	
1.181	23.4	
1.166	21.6	170°
1.154	20.0	190
1.144	18.7	212
1.136	17.5	217
1.127	16.4	222
1.121	15.5	228
1.094	12.1	232
1.075	9.91	228
1.064	8.40	225
1.047	6.49	222
1.035	5.21	219
1.018	2.65	216
1.009	1.36	214

Muriatic acid combines with various bases, and forms a class of salts called *muriates*.

With carbon.

3. As far as is known at present, chlorine does not combine with carbon; but it unites with carbonic oxide, and forms an acid gas much heavier than any other gaseous body yet discovered, and called phosgen gas.

With flowers of sulphur.

4. When a current of chloric gas is made to pass over flowers of sulphur, a combination gradually takes place, the sulphur changes its colour, and a fine red liquid is formed more than twice the weight of the sulphur employed. To this compound, originally discovered by Dr Thomson, Mr Davy has given the name of *sulphurane*.

Sulphurane is a liquid of a fine red colour between scarlet and crimson. By transmitted light it appears green. Its specific gravity is 1.623. It smokes very much, is very volatile, and has a smell similar to that of sea plants. Its taste is strongly acid, hot and bitter, affecting the throat with a painful tickling. It dissolves phosphorus readily, and forms an amber coloured liquid, which at last catches fire when left to spontaneous evaporation. When dropt into nitric acid it effervesces with considerable violence. With alcohol it becomes hot, and the smell of ether becomes perceptible. When dropt into water, it is gradually decomposed. Flocks of sulphur separate, and the water contains sulphuric and muriatic acids in solution. With ammoniacal gas it forms a solid red compound, which is decomposed and converted into sulphate and muriate of ammonia and sulphur by the action of water. Such are the properties of this remarkable compound as far as they have been hitherto ascertained. We are not acquainted with the proportion of its constituents.

With phosphorus.

4. When phosphorus is introduced into chloric gas it takes fire spontaneously, and burns with a low white flame, and at the same time melts. Two substances are formed, one a clear liquid, the other a dry white matter which sublimes during the combustion. To this compound Mr Davy has given the name of *phosphorane*.

Phosphorane appears to possess some acid qualities, at least it combines with ammonia, and forms a white insoluble tasteless powder, very similar to silica in many of its properties. When phosphorane is digested in water, it is decomposed and converted into phosphoric and muriatic acids.

Boracium. 5. We are not yet acquainted with the combination of boracium and chlorine.

Potassium. 6. Chlorine readily combines with potassium, and forms the compound usually distinguished by the name of *muriate of potash.* Mr Davy proposes to give it the name of *potassane.*

Potassane. When potassium is heated in chloric gas, it burns with great splendour, and potassane is formed. The same compound is obtained when potash and chlorine are brought in contact; but in that case the oxygen gas, which previously constituted one of the ingredients of the potash, is evolved. When potash and muriatic acid are brought in contact, water is formed, and the same compound obtained.

Potassane crystallizes in irregular cubes. Its taste is salt, and rather bitter. It dissolves in thrice its weight of cold water. Little altered by exposure to the air. In a red heat it melts, and loses about three per cent. of its weight. Not sensibly soluble in alcohol.

According to the experiments of Mr Davy, it is composed of 55.5 potassium,
44.5 chlorine.

100.0

Sodium. 7. The combination of chlorine and sodium has been known and in general use from the remotest ages, under the name of *common salt* or *muriate of soda.* Mr Davy has given it the name of *sodane.*

Sodane. It exists abundantly in sea-water, from which it is obtained by evaporation. Mines of it occur also in different parts of the world. It crystallizes in cubes. Its taste is universally known, and is what strictly speaking is denominated salt. It dissolves in rather less than thrice its weight of water, and is nearly equally soluble in cold and hot water. It is insoluble in pure alcohol. It deliquesces somewhat when exposed to moist air. In a red heat it melts and loses about two per cent. of its weight. In a violent heat it evaporates.

Common salt, from the experiments of Mr Davy, is composed of 40.17 sodium,
59.83 chlorine.

100.00

Ammonia. 8. As far as we know at present, chlorine has not the property of combining with ammonia.

Barium. 9. Chlorine combines with barium, and forms the compound usually distinguished by the name of *muriate of barytes.* Mr Davy calls it *bariane.*

Bariane. This salt crystallizes in four-sided prisms, whose bases are squares; but it is obtained more commonly in tables. It has a pungent and disagreeable taste; and, like all other preparations of barytes, is poisonous. It requires rather more than twice its weight of water to dissolve it. It is not sensibly soluble in pure alcohol. It is not altered by exposure to the air. In a red heat it melts, but is not decomposed.

Strontium. 10. It combines with strontium, and forms the compound usually distinguished by the name of *muriate of strontian.* Mr Davy calls it *strontiane.*

Strontiane. This salt crystallizes in long slender hexagonal prisms, usually so minute as to have the appearance of needles. It dissolves in rather less than its weight of cold water, while boiling water dissolves any quantity of it whatever. It dissolves in about 24 parts of pure alcohol. The crystals are not much altered by exposure to the air. When heated they undergo the watery fusion, and in a red heat are converted to a white powder.

Calcium. 11. Chlorine combines likewise with calcium, and forms the substance usually distinguished by the name of muriate of lime. Mr Davy calls it *calciane.*

Calciane. This salt is not easily procured in crystals, on account of its great solubility in water. Its crystals are six-sided striated prisms, terminated by very sharp pyramids. Its taste is very bitter and pungent. At the temperature of 60° water dissolves four times its weight of this salt, and it dissolves any quantity whatever at the temperature of 100°. Alcohol seems capable of dissolving more than its own weight of this salt. This salt deliquesces very speedily when exposed to the atmosphere. When heated, it melts and loses its water of crystallization. In a violent heat it loses also a portion of its acid, and then has the property of shining in the dark. In that state, it is called the *phosphorus of Homberg.*

Magnium. 12. Magnium, as far as we know at present, does not combine with chlorine.

Mr Davy considers bariane, strontiane, and calciane, as composed of 32.9 of chlorine, combined with 71 barium, 46 strontium, and 21 calcium.

Gold. 13. The compound of gold and chlorine, usually called *muriate of gold,* has not been accurately examined. It is a yellow coloured salt, having an acrid taste, and deliquescing in the air.

Platinum. 14. Neither are we well acquainted with *muriate of platinum,* which is in reality a compound of chlorine and platinum.

Silver. 15. Silver combines with chloric acid in the proportion of 2 grains of the metal to $\frac{9}{10}$ths of a cubic inch of the gas. The compound is an insoluble powder, usually called *hornsilver*, or *muriate of silver.* Mr Davy calls it *argentane.*

Argentane. This salt is easily obtained, by pouring common salt into a solution of nitrate of silver. It is at first a heavy white curdy precipitate, but it soon blackens when exposed to the air. It is insoluble in water. When heated to about 500°, it melts into a grey coloured semi-transparent mass, having some resemblance to horn, and formerly called *luna cornea.* When heated with potash, or when boiled with water and iron filings, it is decomposed, and the silver reduced to the metallic state. It dissolves in ammonia; it is likewise soluble in muriatic acid, and by that means may be obtained in octahedral crystals. One hundred parts of dry muriate of silver contain about 75.5 parts of pure silver.

Argentane is composed of
75.5 silver,
24.5 chlorine,

100.0

Mercury. 16. Chlorine combines in two proportions with mercury, and forms two compounds of great importance, distinguished by the names of *corrosive sublimate* and *calomel.* The first is a compound of two grains of mercury, and 1.05 cubic inches of chloric gas: the second contains the same quantity of mercury united to half the portion of gas.

Corrosive sublimate was known to the alchymists. A vast number of methods of preparing it have been made public. The most common method is to mix together equal weights of dry oxynitrate of mercury, decrepitated common salt, and calcined sulphate of iron. One-third of a matrass or phial is filled with this mixture. The vessel is placed in a sand bath, and gradually heated to redness. A cake of corrosive sublimate sublimes into the upper part of the vessel. It may be formed directly by dissolving red oxide of mercury in muriatic acid.

It has usually the form of a white semi-transparent cake composed of small prisms. Its specific gravity is 5.1398. Its taste is excessively acrid and caustic, and it leaves for a long time a very disagreeable styptic metallic impression on the tongue. It is one of the most virulent poisons known. It is soluble in about 20 parts cold and 3 parts boiling water. Alcohol dissolves nearly half its weight of it. It is not altered by exposure to the air. When heated it sublimes very readily, and the fumes are very dangerous when inhaled. It is soluble in sulphuric, nitric, and muriatic acids, decomposed by the alkalies, and precipitated of a brick red colour. The alkaline earths likewise decompose it, and ammonia forms with it a triple compound.

Calomel is prepared by triturating four parts of corrosive sublimate and three parts of mercury in a mortar, and then subliming the mixture in a matrass. It is a dull white mass, which becomes yellowish when reduced to powder. When slowly sublimed, it crystallizes in four-sided prisms, terminated by pyramids. Its specific gravity is 7.1758. It is insoluble in water. It is tasteless. When rubbed in the dark it phosphoresces. It requires a higher temperature to sublime it than oxymuriate of mercury. Chlorine and nitric acid convert it into oxymuriate corrosive sublimate.

Copper. 17. Chlorine combines in two proportions with copper, and forms two compounds, distinguished by the names of *cuprane* and *cupranea*. To form the first of these compounds, two grains of copper combine with 3.4 cubic inches of chloric gas.

Cuprane. Cuprane was discovered by Boyle, who gave it the name of *resin of copper*, from its colour. Proust afterwards discovered it anew, and gave it the name of *white muriate of copper*. It may be obtained by exposing copper filings to the action of chloric gas, by heating together two parts of corrosive sublimate, and one part of copper filings, by boiling copper filings in muriatic acid, or by exposing copper filings, partially immersed in muriatic acid, to the atmosphere. Cuprane is fusible in a heat just below redness; and in a close vessel it is not decomposed nor sublimed by a strong red heat; but when the air is admitted, it is dissipated in dense white fumes. It is insoluble in water, effervesces in nitric acid, is soluble in muriates, but is precipitated unaltered by the effusion of water. It is usually opake, of a dark brown colour, and of a confused hackly texture; but by slow cooling, it may be obtained light yellow, semitransparent, and crystallized in small plates.

Cupranea. Cupranea may be formed by heating cuprane in chloric gas; but it is most readily obtained by evaporating the deliquescent muriate of copper to dryness, at a temperature not much above 400° Fahrenheit. It is a yellow powder, decomposed by heat; absorbs water from the atmosphere, and is changed into deliquescent muriate. The constituents of these two compounds, according to the experiments of Mr John Davy, are as follows:

Cuprane of 60 copper + 32.77 chlorine = 92.77
Cupranea of 60 + 67.20 = 127.20

Iron. 18. Iron likewise combines in two proportions with chlorine, forming two compounds, which have received the names of *ferrane* and *ferranea*.

Ferrane. Ferrane may be obtained by evaporating the green muriate of iron to dryness, and exposing the residue to a red heat in a glass tube, with a very narrow orifice. It has a greyish variegated colour, a metallic splendor, and a lamellar texture. It dissolves in water, and forms the green muriate of iron.

Ferranea. Ferranea may be obtained by burning iron wire in chloric gas. It sublimes during the combustion in the form of small brilliant iridescent plates. It dissolves in water, and the solution is identical with the red muriate of iron.

These two compounds, according to the experiments of Mr John Davy, are composed as follows:

Ferrane of 29.5 iron + 33.60 chlorine = 63.1
Ferranea of 29.5 + 55.50 = 85.0

Tin. 19. Tin likewise combines with two doses of chlorine, and forms the two compounds distinguished by the names of *stannane* and *stannanea*.

Stannane. Stannane may be obtained by heating together an amalgam of tin and calomel, or by evaporating the muriate of tin to dryness, and fusing the residue in a close vessel. It has a grey colour, a resinous lustre and fracture, and takes fire when heated in chloric gas. It melts at a heat below that of dull redness; when exposed to a strong heat, it is partially decomposed. It is converted into stannanea when heated with corrosive sublimate, nitre, red oxide of mercury, and hyperoxymuriate of potash.

Stannanea. Stannanea, or liquor of Libavius, may be obtained by heating together amalgam of tin and corrosive sublimate, or by mixing a concentrated solution of peroxide of tin in muriatic acid with sulphuric acid, and applying a moderate heat. This liquor smokes violently when exposed to the air. When mixed with about one-third of its weight of water, it crystallizes. Mr John Davy found, that it had the property of setting oil of turpentine on fire. According to the experiments of this gentleman, these two compounds are composed as follows:

Stannane of 55 tin + 33.4 chlorine = 88.4
Stannanea of 55 + 67.0 = 122.0

Lead. 20. Lead, as far as is known, combines only in one proportion with chlorine. Plumbane. *Plumbane* may be obtained by decomposing the nitrate of lead by means of muriatic acid, and fusing the precipitate in a glass tube with a narrow orifice. It is the substance formerly well known under the name of horn lead. It is composed of 97.2 lead + 33.8 chlorine.

Zinc. 21. Zinc only forms one compound with chlorine. Zincane. It has received the name of *zincane*. It may be obtained by evaporating to dryness the muriate of zinc, and fusing the residue in a glass tube. It is not volatile at a strong red heat in close vessels. When exposed to the air it diliquesces. It is composed of 34.5 zinc + 34.4 chlorine.

Bismuth.

22. Bismuth combines readily with chlorine, and forms the substance formerly known by the name of *butter of bismuth.* It is now called *bismuthane,* and is composed of 67.5 bismuth + 34 20 chlorine.

Bismuthane.

Antimony.

23. Two grains of antimony absorb 3.1 cubic inches of chloric gas. The result is the compound formerly called *butter of antimony.* It was prepared by triturating together one part of antimony and two parts of corrosive sublimate, and distilling the mixture. The butter of antimony passes over in the state of a thick fatty mass of a greyish white colour, and often crystallized in four-sided prisms. It is very caustic, becomes coloured when exposed to the air, and melts at a moderate temperature. Antimonane (as this compound is called) is composed of 42.5 antimony + 34.6 chlorine.

Antimonane.

Tellurium.

24. Two grains of tellurium absorb 2.4 cubic inches of chloric gas. The product is a substance resembling butter of antimony in its appearance.

Arsenic.

25. Two grains of arsenic absorb 3.6 cubical inches of chloric gas. The product is the substance usually called *butter of arsenic.* A dense, limpid, highly volatile fluid, a non-conductor of electricity, and of high specific gravity. When decomposed by water, it gives muriatic acid, and white oxide of arsenic, similar, in this respect, to most of the combinations of chlorine with the metals. It is composed of 21.9 arsenic + 33.6 chlorine.

Manganese.

26. Manganese absorbs chloric gas, and forms a compound of a deep brown colour, and not volatilized at a dull red heat. It may be obtained by heating the dry muriate of manganese to redness. It is pink coloured, and composed of 28.4 manganese, + 33.6 chlorine.

Tungsten.

27. Tungsten absorbs chloric gas, and forms an orange-coloured sublimate.

The remaining combinations of chlorine with metals are still unknown.

Chap. VIII.

Of Compound Combustibles.

Compound combustibles.

The compound combustibles are usually composed of carbon and hydrogen, or of carbon, hydrogen, and oxygen. They are very numerous, including almost all the animal and vegetable bodies. But the progress of the investigation of these bodies, and their importance in chemical investigations, is not such as to warrant their introduction here. We shall describe only those compound combustibles which are of importance as instruments of chemical analysis. These may be comprehended under the five following heads. 1. Alcohol. 2. Ethers. 3. Volatile oils. 4. Fixed oils. 5. Bitumens.

Sect. I. *Of Alcohol.*

Alcohol.

The liquid called *alcohol,* or *spirit of wine,* is obtained when wine, beer, or other fermented liquors are subjected to distillation. The ancients were unacquainted with it. We do not know the discoverer of this liquid, but it was known to the alchymists, and introduced by them into pharmaceutical preparations.

How obtained.

It is by the distillation of fermented liquors that ardent spirits are obtained, and they receive various names according to the nature of the substance employed. Thus *brandy* is obtained from *wine, rum* from the fermented juice of the *sugar cane, whisky* and *gin* from the fermented infusion of *malt* or *grain.* Now, ardent spirits consist almost entirely of three ingredients; namely, water, pure spirit or alcohol, and a little oil or resin, to which they owe their flavour and colour. When these liquids are re-distilled, the first portion that comes over is a fine light transparent liquid, known in commerce by the name of *rectified spirits.* When as highly rectified as possible, the specific gravity of the liquid obtained does not appear to be less than 0.820, and is generally more. Alcohol, by this process, cannot be deprived of the whole of the water with which it is combined. The best method of getting rid of the water is to expose a quantity of the salt called *muriate of lime* to a red heat, to put it into a retort while still warm, and to pour over it a portion of alcohol of about 0.820, nearly equal to it in weight. The alcohol dissolves the salt, and much heat is evolved. This mixture is to be exposed to heat, and the alcohol distilled off. The salt retains the water, and the alcohol comes over of the specific gravity 0.791 at 68°, or 0.796 at 60°. In this state it is the strongest alcohol that can be procured. It is, therefore, called *pure,* or *absolute alcohol.* The alcohol of commerce is never so strong as this; its specific gravity is seldom under 0.837.

Its properties.

Alcohol, thus procured, is a transparent liquid, colourless as water, of a pleasant smell, and a strong penetrating agreeable taste. When swallowed, it produces intoxication. It cannot be frozen in the greatest degree of cold to which it has been exposed, and it has been cooled down in thermometer tubes to —91°. It is very volatile, evaporating spontaneously at the common temperature of the atmosphere. When heated to 173½° it boils, and is converted into an elastic fluid, possessing the mechanical properties of air, but more than twice as heavy.

It combines with water in every proportion, and forms spirits of different degrees of strength according to the quantity of water present. The common spirits of commerce are nothing else than such combinations of alcohol and water. The proportion of alcohol present in these liquids is best judged of by their specific gravity. The specific gravity of pure alcohol is 0.796. That of water 1.000. Hence the lighter a spirit is, the stronger is it. Alcohol of 0.820 contains nearly $\frac{1}{10}$th of its weight of water; alcohol of 0.840 contains $\frac{17}{100}$ parts of water. What in this country is called *proof spirits,* is of the specific gravity 0.920. It was understood to be a mixture of equal bulks of alcohol and water. This, however, is not the case. It contains 0.52 of its weight of water. When spirits are weaker than 0.920, they are said to be *under proof;* when stronger, to be *above proof.* The spirits retailed in Scotland are almost always under proof, and sometimes indeed very weak.

Neither common air nor oxygen gas act upon alcohol at the common temperature, but in high temperatures the case is different. When alcohol is kindled in the open air, it burns all away without leaving any residuum. The flame is blue, and if the vapours emitted be collected, they are found to consist of carbonic acid and water, and the portion of water formed is greater than the whole of the alcohol consumed. When the vapour of alcohol is mixed with oxygen gas, it may be kindled by an electric spark provided the temperature be above 70°, a detonation takes place, the alcohol is consumed, and water and carbonic acid formed. When alcohol is passed, in the state of vapour, through a red-hot porcelain or metallic tube, it is decomposed, and a variety of new products evolved. These are, 1. A great quantity of inflammable air, which, according to Saussure junior, consists of oxygen, hydrogen, carbon, and azote; 2. A little charcoal; 3. A little oil, partly in crystals, partly fluid; 4. A portion of water, holding in solution traces of acetic acid and ammonia; 5. A little of an acid which resembles the benzoic. By estimating the proportions of ingredients formed in these decompositions, chemists have endeavoured to ascertain the constituents of alcohol. The following is the result obtained by Saussure junior, who has lately published an elaborate set of experiments on the constituents of alcohol. It is composed of

Composition.

Oxygen, - - -	37.85
Carbon, - - -	43.65
Hydrogen, - - -	14.94
Azote, - - - -	3.52
Ashes, - - - -	0.04
	100.00

Alcohol has little action on the simple combustibles. On hydrogen and charcoal it seems to produce no effect. But it dissolves a little phosphorus and sulphur. If phosphureted alcohol be dropt into water, a lambent flame is observed playing on the surface of the liquid, and the phosphorus is disengaged.

Alcohol dissolves the fixed alkalies. It is by means of it, indeed, that these bodies are obtained in a state of purity. The earths are scarcely acted on by alcohol. It absorbs a quantity of nitrous gas, which cannot afterwards be expelled by heat.

The strong acids decompose alcohol. The rest combine with it, and form a set of compounds hitherto but little examined. It dissolves also a considerable number of salts, especially the acetates, muriates and nitrates. The sulphates are all insoluble in it. The colour of the flame of alcohol is tinged by various bodies. Thus nitrate of strontian tinges it purple; boracic acid and the cupreous salts tinge it green; muriate of lime gives it a light red colour; nitre and oxymuriate of mercury a yellow colour.

SECT. II. *Of Ethers.*

Ethers.

When alcohol is acted upon by several of the acids, a fragrant liquid is formed, to which the name of *ether* has been given. These ethers are named from the acid employed in forming them. As they differ in their properties, it will be requisite to describe them separately.

1. *Sulphuric Ether.*

Sulphuric ether.

This liquid was known about the end of the 15th century, and some of its properties were described by Boyle; but the attention of chemists was first drawn to it by a paper published in the Philosophical Transactions for 1730, by a German who called himself Dr Frobenius.

How obtained.

It may be obtained by distilling a mixture of equal parts of alcohol and sulphuric acid in a glass retort, to which a large receiver is attached. The ether condenses in the receiver. When first prepared, it contains some sulphurous acid, which is removed by putting some powdered chalk into it, and agitating repeatedly in a close phial, till the sulphurous acid smell is dissipated. The ether is then distilled a second time. It still retains a portion of alcohol, from which it may be freed by adding to it dry muriate of lime as long as it will dissolve that dry salt, and leaving the solution in a well corked phial. The muriate of lime dissolved in the alcohol gradually subsides, and the pure ether floats on the top. It may be decanted off.

Its properties.

Ether thus obtained is a limpid and colourless fluid like water. It has a peculiar and agreeable smell, and a hot pungent taste. Its specific gravity when pure is only 0.632 at 60°; but the ether of commerce is seldom lower than 0.775, owing to the alcohol which it contains.

It is so volatile that it cannot be poured from one vessel to another without considerable loss. When exposed to the open air, it disappears in a very short time. It boils at 98°, and in a vacuum at —20°. When evaporated, it produces a considerable degree of cold, so that water may be easily frozen by means of it even in summer. The specific gravity of the vapour of ether, according to Dalton, is 2.25, that of air being 1.00. When ether is exposed to a cold of —46°, it freezes and crystallizes.

Neither oxygen gas nor air produce any effect upon ether at the common temperature of the atmosphere; but when kindled in contact with these fluids, it burns with a strong white flame, giving out a great deal of light and heat. The products in this case are carbonic acid and water. It consumes, during its combustion, about seven times its bulk of oxygen, supposing the ether in the gaseous state. When mixed with oxygen gas in that proportion, it explodes very loudly when an electric spark is passed through the mixture. Various attempts have been made to estimate the constituents of ether by consuming it with oxygen gas, and ascertaining the products obtained. The following is the composition of ether, according to the experiments of Saussure junior.

Composition.

Carbon, - - -	58.20
Hydrogen, - - -	22.14
Oxygen, - - -	19.66
	100.000

These numbers indicate a much greater proportion of carbon and hydrogen, and a much smaller proportion of oxygen in sulphuric ether than in alcohol.

When ether is passed through a red hot porcelain tube, it is decomposed and converted into oil, charcoal, water, and a great proportion of heavy inflammable gas.

Ether combines only in a small proportion with water. Ten parts of that liquid dissolve about one part of ether. But alcohol unites with ether in any proportion.

Ether dissolves a little phosphorus and sulphur, but does not seem to act upon the other simple combustibles. It has no action on the metals, but revives those metallic oxides which readily part with their oxygen, as the oxides of gold and silver. It dissolves the muriate of gold, and the oxymuriate of mercury.

It does not appear to have any action on the alkalies or earths. It readily dissolves ammonia and nitrous gas.

Sulphuric acid seems capable of converting it into sweet oil of wine. Oxymuriatic acid sets it on fire spontaneously. The action of the other acids has not been ascertained.

It dissolves the fixed and volatile oils, and bitumens, but does not act upon gums.

From its constituents, as ascertained by Saussure, compared with those of alcohol, it is obvious that, during the formation of sulphuric ether, the alcohol is decomposed. This decomposition, according to Fourcroy and Vauquelin, is owing to the high temperature to which the alcohol is subjected, in consequence of being prevented from evaporating so easily by the sulphuric acid with which it is combined.

2. *Nitric Ether.*

Nitric Ether.

This ether is mentioned by some of the older chemists, but its properties were almost unknown till it was lately examined by Thenard.

How obtained.

It may be formed by distilling a mixture of equal parts of alcohol and nitric acid of the specific gravity 1.283 in a retort, from which passes a tube that goes to the bottom of a tall glass jar half filled with a saturated solution of common salt in water. Several of these jars are connected together by tubes, and from the last a tube passes to convey the gaseous products to the water trough. The ether condenses on the surface of the liquid in these jars. It contains at first a little nitrous and acetic acids, from which it is purified by agitation with chalk in a close phial till it ceases to redden vegetable blues.

Its properties.

Nitric ether thus prepared has a pale yellow colour, and a very strong ethereal odour. Its taste is strong and quite peculiar. It is rather heavier than alcohol, but much more volatile than sulphuric ether. Hence it only moistens bodies for a moment, and produces a considerable cold by its evaporation. The heat of the hand is sufficient to make it boil.

It dissolves in 48 parts of water, and communicates to that liquid an odour like that of apples. It dissolves in alcohol in any proportion. It burns with a white flame, and as brilliantly as sulphuric ether. When kept for some time, both nitric and acetic acids are evolved in it. The same acids make their appearance if the ether be heated, or if it be agitated in water. When brought in contact with a little of these acids, it instantly absorbs them, and acquires the property of reddening vegetable blues.

At the temperature of 70°, it quintuples the bulk of gases. At that temperature its vapour is capable of supporting a column of mercury 28.74 inches high. Hence its boiling point is obviously only a degree or two above 70°.

Composition.

From the analysis of Thenard, the constituents of nitric ether are as follows:

Oxygen, - - -	48.52
Carbon, - - -	28.45
Azote, - - -	14.49
Hydrogen, - - -	8.54
	100.00

It is probable that it contains nitric acid ready formed, as one of its constituents, and that this acid is neutralized by the spirit, and thus prevented from acting on vegetable blues. It is obvious from the preceding account of its properties, that nitric ether differs entirely from sulphuric ether in its nature.

3. *Muriatic Ether.*

Muriatic ether.

After the discovery of sulphuric and nitric ether, various attempts were made to procure muriatic ether, and different processes were suggested. Sometimes a mixture of alcohol and those metallic muriates that contain an excess of acid were distilled, and sometimes alcohol was saturated with muriatic acid gas and distilled. The nature of muriatic ether was almost unknown till a set of experiments was made on it by Gehlen in 1804. Thenard made another in 1807. To the labours of these two chemists we are indebted for all the knowledge we possess of this singular fluid.

How obtained.

It may be obtained by distilling in a retort equal bulks of alcohol and muriatic acid, both as strong as possible. From the retort a tube passes into a Woulfe's bottle, partly filled with water, and from the bottle another tube passes into the water trough. The whole of the ether formed assumes the gaseous form if the temperature be as high as 70°, and may be collected in jars over water. A mixture of acid and alcohol weighing 30 ounces troy, yields more than 1200 cubic inches of this ethereal gas.

Its properties.

This gas is colourless; it has a strong ethereal smell, and a sweetish taste. It produces no change on vegetable blues or lime water. Its specific gravity is 2.219, that of air being 1.000. At the temperature of 64° water absorbs its own bulk of this gas.

At the temperature of 52° it loses its gaseous form, and becomes liquid ether. It may be obtained in that state by passing it into a jar surrounded with ice. In its liquid state it is colourless like water, and has the same smell and taste as when gaseous. At the temperature of 41° its specific gravity is 0.874. It has no effect on vegetable blues. It is much more volatile than sulphuric or even nitric ether, assuming the gaseous form when not hotter than 64°. It burns with a green coloured flame, and a great quantity of muriatic acid is disengaged during the combustion. Thus it appears that muriatic acid is one of its constituents. But as the presence of that acid cannot be detected before combustion by the usual tests, it is obviously neutralized by the other constituents of the ether. Thenard has endeavoured to ascertain the constituents of this ether. The following are the proportions which he found:

Composition.

Muriatic acid,	29.44
Carbon,	36.61
Oxygen,	23.31
Hydrogen,	10.64
	100.00

During the formation of muriatic ether, no gas whatever is evolved except the ether, and no new product appears except the ether itself. A portion of the muriatic acid disappears, and exactly the same portion makes its appearance again when the ether is burnt. These effects render it probable that muriatic ether is a combination of muriatic acid and alcohol. But if any dependence can be put in the above analysis, and in Saussure's analysis of alcohol, it is obvious that the alcohol in entering into the composition of muriatic ether has been altered, as its constituents are not in the same proportion as in pure alcohol.

4. *Acetic Ether.*

Acetic ether.

Acetic ether was discovered in 1759 by the Count de Lauraguais, who obtained it by distilling a mixture of alcohol and acetic acid. The process has been often repeated, and has been improved since its original discovery. Thenard has lately examined the properties of this ether.

How obtained.

He obtained it by distilling a mixture of strong acetic acid and alcohol in a retort, and repeating the distillation twelve times. No gas was found, nor any symptom of the decomposition of either of the substances used exhibited. He then saturated the acid with potash, and by distilling the liquid off acetate of potash, he got the ether in a separate state.

Its properties.

Acetic ether is limpid and colourless. It has an agreeable odour of ether and acetic acid. It has a peculiar taste, bearing no resemblance to that of alcohol. It does not redden vegetable blues. At the temperature of 44½°, its specific gravity is 0.866. It boils at the temperature of 160°. It burns with a yellowish white flame, and acetic acid is developed. It undergoes no change by keeping. At the temperature of 62°, it requires more than seven times its weight of water to dissolve it. It seems, from the preceding account, to be a kind of combination of acetic acid and alcohol, substances which it seems have the property of neutralizing each other.

5. *Phosphoric Ether.*

Phosphoric ether.

From the late experiments of Boullay, it appears that ether may be formed also by means of phosphoric acid. This acid, of the consistence of honey, was put into a retort, and heated nearly to the temperature of boiling water. Alcohol was then introduced by means of a funnel passing to the bottom of the acid, and the mixture distilled. A liquid was obtained, which, when rectified off muriate of lime, yielded an ether possessing all the properties of sulphuric ether.

How obtained.

Besides these ethers, several others have been formed by means of other acids. Indeed, from the late experiments of Thenard, there is reason to believe that almost all the remaining acids may be made to combine with alcohol, and to form a liquid which might be denominated an ether, by distilling a mixture of alcohol, sulphuric acid, and the acid in question.

From the preceding detail, it appears that there are two kinds of ether essentially distinct: The first, consisting of sulphuric and phosphoric ethers, is formed by the decomposition of alcohol, and contains no acid. All the others contain an acid, and several of them seem to be combinations of an acid and alcohol. Alcohol appears to have the property of neutralizing acids, a property not suspected till lately; though several other vegetable substances seem to possess the same property.

SECT. III. *Volatile Oils.*

Volatile oils.

The term *oil* is applied to a number of liquids, which, when dropt upon paper, sink into it, and make it semitransparent, or give it what is called a *greasy* stain. Chemists have divided them into two classes, *fixed* and *volatile.*

Their properties.

Volatile oils, called also *essential oils*, are distinguished by the following properties:

1. Liquid, often as liquid as water; sometimes viscid.
2. Very combustible.
3. An acrid taste and a strong fragrant odour.
4. Volatilized at a temperature not higher than 212°.
5. Soluble in alcohol, and imperfectly in water.
6. Evaporate without leaving any stain on paper.

How obtained.

Volatile oils are almost all obtained from vegetables, and they exist in every part of plants except the cotyledons of the seed, where they have never been found. They are sometimes obtained from plants by simple expression. But in general they are procured by mixing the vegetable substance containing them with water, and distilling. The oil comes over along with the water, and swims on its surface in the receiver.

They are very numerous, but a detailed account of each would not be interesting; a general account of their properties will be sufficient for our purpose.

Most of them are liquid. Some indeed are as liquid as water, as oil of turpentine. Some are viscid, and some of the consistence of butter, or even more solid.

Their colours are very various. Some are colourless like water. Some yellow, brown, blue, green, &c.

Their odours are so various as to defy all description. It is sufficient to say, that all the fragrance of the vegetable kingdom resides in volatile oils. Their taste is acrid, and sometimes they are even corrosive.

Their specific gravity is also various. Oil of turpentine, the lightest oil known, is 0.792, and oil of sassafras, the heaviest, is 1.094.

They evaporate very readily in the open air, diffusing their fragrant odour around. In close vessels the heat necessary to distil them over appears to be greater. When cooled they congeal; but the temperature necessary to produce this effect varies in different oils. Some become solid at 50°, others not till cooled down to —17°. Several of them yield crystals of camphor and of benzoic acid when thus treated.

When exposed to the light, they acquire consistency, and assume a brown colour. Dr Priestley ascertained, that they imbibe oxygen with avidity. Probably these changes are connected with that absorption. By long exposure, several of them assume the form of resins.

When heated sufficiently, they take fire, and burn with a strong yellow flame, emitting a great quantity of smoke. The products of the combustion, besides the soot deposited, are water and carbonic acid.

When agitated in water, they render it milky, and communicate their peculiar odour. They dissolve in alcohol, ether and fixed oils.

They dissolve a little phosphorus and sulphur, but do not act on hydrogen or charcoal.

The alkalies and earths act but feebly on the volatile oils. The compounds formed have been called *saponules*. It is probable that they assume the form of resins before they combine with these bodies.

Sulphuric acid decomposes them, converting them first into a kind of resin, and at last into charcoal. Concentrated nitric acid sets them on fire. The diluted acid converts them into a kind of yellow resin.

They scarcely act upon metals; but they have a tendency to reduce some of the metallic oxides.

From the products obtained when the volatile oils are burnt, it has been concluded that they are compounds of carbon and hydrogen. But no exact analysis of any of them has hitherto been made.

Sect. IV. *Of Fixed Oils.*

Fixed oils.

The fixed oils, which are of so extensive utility, have been known from the remotest ages. They may be distinguished by the following properties.

Their properties.

1. Liquid, or easily become so when exposed to a gentle heat.
2. An unctuous feel.
3. Very combustible.
4. A mild taste.
5. Boiling point not under 600°.
6. Insoluble in water and alcohol.
7. Leave a greasy stain upon paper.

How obtained.

These oils, called also *fat*, or *expressed oils*, are obtained partly from animals, partly from vegetables, by simple expression. They occur chiefly in the seeds of bicotyledinous plants, and in the livers of animals. Whale oil, spermaceti oil, olive oil, and linseed oil, may be mentioned as examples of fixed oils.

Fixed oil is usually liquid, with a certain degree of viscidity. It has usually a yellowish or greenish tinge. Its taste is sweet, or nearly insipid. When fresh it has no smell.

Many solid bodies also are obtained from vegetables which have been hitherto confounded with the fixed oils, as palm oil, shea butter, &c. From the late experiments of Dr Bostock, these substances seem to approach the nature of wax rather more than that of fixed oils.

The fixed oils are all lighter than water. Their specific gravity varies from 0.968 to 0.892.

Fixed oil does not begin to evaporate till heated above 212°. As the heat increases, a pretty copious vapour may be seen to rise; but the oil does not begin to boil till heated nearly to 600°. It may be distilled over, but it is always altered by the process. Some water and acetic acid seem to be formed; heavy inflammable air is given out. The oil deepens in colour, and acquires a disagreeable taste and smell.

Fixed oil, when kindled, burns with a yellowish white flame, and is decomposed. The products are carbonic acid and water. When exposed to cold, they congeal or crystallize, and at the same time their bulk diminishes very considerably.

When exposed to the action of air, they undergo different changes according to the nature of the oil. They gradually absorb oxygen and become solid. Now there are some that retain their *transparency* after they have become solid, while others assume the appearance of *tallow* or *wax*. Those that remain transparent are called *drying oils*; those that become opake, are called *fat oils*.

Drying oils.

The drying oils are used as a vehicle of paints and varnishes. Linseed, nut, poppy, and hempseed oils belong to this class. They acquire the property of drying oils more completely after they have been boiled. For some purposes it is common to set them on fire, and, after they have burnt for some time, to extinguish them, and continue the boiling till they have acquired the requisite viscidity. By this process, they lose the property of leaving a greasy stain upon paper, and acquire many properties in common with the resins. In this way, nut-oil and linseed-oil are prepared for printers ink. The oil, thus altered, still continues insoluble in water and alcohol, but it readily unites with fixed oil.

Fat oils.

The *fat oils*, when exposed to the air, gradually become thick, opake, and white, and assume an appearance very much resembling wax or tallow. Olive-oil, oil of sweet almonds, of rape-seed, and of ben, may be mentioned as examples of this class.

The action of the simple combustibles on the fixed oils is not very remarkable. Hydrogen has no action. Charcoal renders them purer when they are filtered through it; but separates from them with such difficulty that it cannot be employed for that purpose with advantage.

They dissolve a little phosphorus and sulphur when assisted by heat.

They are insoluble in water, alcohol, and ether; but they unite readily with each other, with volatile oils, with bitumens, and with resins.

The fixed alkalies combine with them readily, and form with them the important compound called *soap*. Potash forms with them only soft soap, while soda forms hard soap. The earths likewise and metallic oxides combine with the fixed oils, and form a kind of soap insoluble in water.

Sulphuric acid gradually decomposes the fixed oils, blackening their colour, and at last evolving charcoal. Nitric acid acts with still greater energy. When poured suddenly on the drying oils, it sets them on fire. When suddenly diluted, it converts them all into substances similar to resins or tallow.

The fixed oils oxidize some of the metals, as copper and mercury. They combine with various metallic oxides, as those of arsenic, lead, and bismuth; and are capable of forming with several, the viscid compounds called *plasters*.

They are liable, by keeping, to become *rancid*. They become thick, acquire a brown colour, an acrid taste, and a disagreeable smell. The oil, thus altered, converts vegetable blues to red, and of course contains an acid. This change is, at present, ascribed to a decomposition of the mucilaginous matter which is dissolved in all oils, or to the action of that matter in the oil.

When oils are burnt, the only products are carbonic acid and water. Lavoisier, from a set of experiments made in this way on olive-oil, deduced its composition as follows:

Carbon,	79
Hydrogen,	21
	100

But the experiments of Thenard and Gay-Lussac, made in a different way, give its constituents as follows:

Carbon,	77.213
Hydrogen,	13.360
Oxygen,	9.427
	100

Many oils occur in the vegetable kingdom, which are intermediate in their properties between the fixed and volatile oils. Like the volatile oils, they are soluble in alcohol; but, like the fixed, they cannot be distilled over with that liquid. Hence they may be obtained by digesting the substance containing them in alcohol, and then separating the alcohol by evaporation.

Empyreumatic oils.

Many oils are formed when animal and vegetable bodies are exposed to a heat above that of boiling water. These oils are called *empyreumatic*. They are usually dark-coloured, have an acrid taste and a disagreeable smell, and possess most of the properties of the volatile oils.

SECT. V. *Of Bitumens.*

Bitumens.

The term *bitumen* has been often applied to all the inflammable substances which occur in the earth. But it is better to limit it to those *fossil bodies* only which have a certain resemblance to oily and resinous substances. They may be divided into two classes. The first set possess nearly the properties of volatile oils; while the second set possess a peculiar character. The first class may be called *bituminous oils*. The second, *bitumens proper*.

1. *Bituminous Oils.*

Bituminous oils.

Only two species of bituminous oils have been hitherto examined, namely, *naphtha* or *petroleum*, and *maltha* or *sea wax*.

Naphtha.

1. Naphtha, or petroleum, is an oil of a brownish yellow colour. When pure, fluid as water, and pretty volatile. Its specific gravity varies from 0.730 to 0.878. It has a peculiar smell. When heated, it may be distilled over without alteration. It unites with alcohol, ether, volatile and fixed oils, and, as far as is known, possesess all the characters of volatile oils.

When found in the earth pure, it is distinguished by the name of *naphtha*; when less fluid and darker coloured, it is called *petroleum*. When petroleum is distilled, naphtha is obtained from it.

Maltha.

2. Maltha, or sea-wax, is a solid substance found on the Baikal lake in Siberia. It is white, melts when heated, and on cooling assumes the consistence of white cerate. It dissolves in alcohol, and seems to possess the character of a solid volatile oil.

2. *Proper Bitumens.*

Proper bitumens.

The true bituminous substances may be distinguished by the following properties:

1. They are either solid, or of the consistence of tar.
2. Their colour is usually brown or black.
3. They have a peculiar smell, or at least acquire it when rubbed. This smell is known by the name of the *bituminous odour*.
4. They become electric by friction, though not insulated.
5. They melt when heated, and burn with a strong smell, a bright flame, and much smoke.
6. They are insoluble in water and alcohol, but dissolve most commonly in ether and in fixed and volatile oils.
7. They do not dissolve in alkaline leys, nor form soap.
8. Acids have little action on them; the sulphuric scarcely any: the nitric, by long and repeated digestion, dissolves them, and converts them into a yellow coloured substance, soluble both in water and alcohol.

The pure bitumens at present known are three, namely, *asphaltum*, *mineral tar*, and *mineral caoutchouc*. United to resin, it forms a curious substance called *retinasphaltum*. United to charcoal, it forms the various species of pit-coal so important as articles of fuel.

Asphaltum.

1. Asphaltum. This substance occurs in great abundance in the island of Trinidad, on the shores of the Dead Sea, in Albania, and in other places. Its colour is black, with a shade of brown, red, or grey. It is heavier than water. It is insoluble in acids, alkalies, water, and alcohol; but soluble in oils, petroleum, and sulphuric ether. See ASPHALTUM.

Mineral tar.

2. Mineral tar. This substance is found in Barbadoes and other places. It is named from its consistence and appearance. It seems to be a mixture of petroleum and asphaltum. Accordingly, when distilled, abundance of petroleum is obtained, of a brown colour, but very fluid.

Mineral caoutchouc.

3. Mineral caoutchouc is a singular substance, hitherto found only in Derbyshire. It is soft and elastic, not unlike common caoutchouc or Indian rubber. Its colour is dark brown, with a shade of green or red. It resists the action of almost all liquid menstrua. Neither alcohol, alkalies, nor nitric acid, affect it. Even oils and petroleum are incapable of dissolving it. When heated it melts, and con-

tinues afterwards of the consistence of tar. In that state it is soluble in oils. It burns with a bright flame and bituminous smell.

Retinasphaltum.

4. Retinasphaltum has hitherto been found only in Derbyshire, accompanying Bovey coal. Mr Hatchett discovered its nature. It has a pale brown ochre yellow colour, is very brittle, and breaks with a vitreous fracture. Its specific gravity is 1.135. When heated, it melts, smokes, and burns with a bright flame, and emits a fragrant odour. It is insoluble in water, but partially soluble in alcohol, potash, and nitric acid. It is composed of

Resin,	55
Asphaltum,	41
Earths,	3
	99

Pit-coal.

5. Pit-coal, one of the most useful of all the mineral productions, may be distinguished into three kinds. 1. Those that still contain vegetable principles, strictly so called, and thus give evident marks of their origin. Some yield *extractive*, others *resin*, besides charcoal and bitumen, which constitute the greatest part of their contents. The term *brown coal*, from their colour, has been applied to the greater number of coals belonging to this set. 2. *Black coal.* In them no vegetable principle can be detected, they are composed of bitumen and charcoal in various proportions, and are usually mixed with more or less of earthy matter. 3. *Glance coal.* In this set no vegetable principle, nor even bitumen, is to be found. The coal consists of charcoal pure, or contaminated with some earth. These coals have a great deal of lustre. They are heavy, and burn without emitting any flame or smoke, and only when heated to redness.

DIVISION II.

On Secondary Compounds.

Secondary compounds.

By the term *secondary compound*, is meant a combination of *primary compounds* with each other. Thus acids combine with alkalies and form *salts*; earths combine with fixed alkalies and form *glass*; oils combine with fixed alkalies and form *soap*. The secondary compounds, as far as we are at present acquainted with them, may be arranged under the five following classes:

1. Combinations of earths with each other, and with metallic oxides.

2. Combinations of earths with alkalies.

3. Combinations of acids with alkalies, earths, and metallic oxides.

4. Combinations of sulphureted hydrogen with alkalies, earths, and metallic oxides.

5. Combinations of oils with alkalies, earths, and metallic oxides.

These combinations may be distinguished by the following titles: 1. Combinations of earths; 2. Glass; 3. Salts; 4. Hydrosulphurets; 5. Soaps.

Chap. I.

Of Combinations of Earths.

Combinations of earths.

This subject is in some measure new, and has been but imperfectly investigated. The following observations are all that can be offered:

1. The earths require so violent a heat to melt them, that they are capable of resisting the most intense fires that we can raise. But in several cases the fusion is much facilitated by mixing various earths together. Thus alumina, in a pure state, is infusible, and so is a mixture of alumina and silica, or *pure clay*. But when lime is added to this substance, it melts with comparative facility. The oxide of iron also acts as a solvent when mixed with other earthy bodies, and greatly facilitates their fusion.

2. The three alkaline earths, lime, barytes, and strontian, resemble each other in their disposition to unite with the other earths. Like the alkalies, they combine with alumina and silica, but shew no affinity for magnesia nor for each other.

3. Magnesia has a marked affinity for alumina, but for none of the other earths. When magnesia and alumina are present together in solutions, alkalies throw them down in combination.

4. Alumina has an affinity for all the alkaline earths. It has also an affinity for silica. These two earths are frequently found combined in nature.

5. Silica has an affinity for the alkaline earths, for alumina, and for zirconia. Silica enters into fusion with all the earths hitherto tried except alumina.

6. Several of the earths are capable of combining likewise with metallic oxides. Hitherto only six metals in the state of oxides have been found native combined with earths. These are, 1. chromium; 2. nickel; 3. copper; 4. zinc; 5. manganese; 6. iron. Chromium constitutes the colouring matter of the *ruby*, in which mineral it is combined with alumina and magnesia. Nickel has been found only in one mineral, the *chrysoprase*, to which it gives a green colour. The same remark applies to copper, which has been found only in the *smaragdite*, and in a very small proportion. Zinc is sometimes found combined with silica in the mineral called *calamine*, which is frequently merely an oxide of zinc. The oxide of manganese is a very frequent ingredient in dark coloured stones, as *schorl*, *garnet*, &c. It is found also combined with barytes.

But it is the oxide of iron which constitutes by far the most common metallic constituent of minerals. No less than seven distinct colours, besides various shades, have been observed in minerals containing iron. These are *white*, *black*, *green*, *blue*, *red*, *yellow*, *brown*.

The oxides of iron melt when heated with barytes, lime, alumina, or silica, when they exceed the proportion of earth considerably. They render mixtures of silica and alumina fusible at a very low heat.

CHAP. II.

Of Glass.

Glass.

SILICA, when mixed with the fixed alkalies and exposed to a strong heat, enters readily into fusion. It melts also when heated along with some of the alkaline earths, as lime, provided a little alumina be present. These mixtures are very ductile while in fusion, and may be readily moulded into any shape we please. If they be suddenly cooled below the temperature at which they become solid, they retain their transparency, and assume those peculiar properties which belong to the substance called *glass*. *Glass*, then, is a combination of the fixed alkalies, or alkaline earths with silica, either alone or conjoined with alumina, brought into complete fusion, and then suddenly congealed. Metallic oxides are sometimes added; they assist the fusion like the alkalies, and communicate frequently a peculiar colour to the vitreous mass.

When glass is in fusion, the substances which enter into its composition may be considered as combined with each other, so as to form a homogeneous mass similar to water holding a variety of salts in solution. If it be cooled down very slowly, the different tendency of the constituents to assume a solid form at peculiar temperatures, will cause them to separate successively in crystals; just as the salts held in solution in water assume the form of crystals as the liquid is slowly evaporated. But if the glass be quickly cooled down to the point of congelation, the constituents have not time to separate in succession, and the glass remains the same homogeneous compound as while in a state of fusion; just as would happen to a saline solution if suddenly exposed to a cold capable of congealing it completely. Hence it appears that the vitreous quality depends entirely upon the fusibility of the mixture, and the suddenness with which it is cooled down to the point of congelation. The substance, though solid, is precisely the same as to its chemical composition as if it were still in fusion; the sudden cooling having fixed the constituents before they had time to assume a new arrangement.

All fusible mixtures of the earths proper with fixed alkalies, alkaline earths, or metallic oxides, may be made at pleasure to assume the form of glass, or the appearance which characterises stone or porcelain, according to the rate of cooling; and glass may be deprived of its vitreous form, merely by fusing it and cooling it down with sufficient slowness to enable the constituents to separate in succession. Sir James Hall found that glass (consisting of various earthy bodies) always loses its vitreous state, and assumes that of a stone, if more than a minute or two elapses while it is cooling down from complete fusion to the point at which it congeals.

There are different kinds of glass in common use for various purposes. The finest are *plate glass*, and *flint glass* or *crystal*. They are perfectly transparent, nearly colourless, heavy, and brilliant. They are composed of fixed alkali, pure siliceous sand or calcined flints, and litharge. *Crown glass* is made without lead; it consists of fixed alkali and siliceous sand, and is much lighter than flint glass. It has a distinct greenish tinge, from the oxide of iron present in the materials employed in making it. Sometimes too great a proportion of oxide of manganese is added, which gives it a purple colour. *Bottle glass* is the coarsest and cheapest kind. It consists chiefly of lime fused with silica and a little alumina, and contains so much iron and manganese as to give it a dark colour, and to diminish its transparency very much. It is much harder, stronger, and more difficultly fusible than the fine kinds of glass.

Glass answers well as a chemical vessel, as it is acted on only by a small number of re-agents. Fluoric acid corrodes it readily; so do the fixed alkalies when assisted by heat. Water, when long boiled in it, disengages some alkali from it, and occasions the separation of silica in the state of a white powder.

CHAP. III.

Of Salts.

Salts.

THE word *salt* was originally confined to *common salt*, a substance which has been known and in common use from the remotest ages. The term was afterwards generalized by chemists, and applied to all bodies which are sapid, easily melted, soluble in water, and not combustible. At length it was confined to acids, alkalies, and the combinations of these bodies with each other. At present the term is applied to all the compounds which the acids form with alkalies, earths, and metallic oxides.

Chemists have agreed to denominate the salt from the *acids* which they contain. The alkali, earth, or metallic oxide, combined with that acid, is called the *base* of the salt. Thus Glauber salt, being a compound of sulphuric acid and soda, is called a *sulphate*, and soda is called the *base* of Glauber salt. Hence it follows, that there are as many genera of salts as there are acids, and as many individual salts, or species, as there are combinations of acids with a base. Silica and some of the metallic oxides do not appear capable of combining with acids. But to compensate this, there are some acids which combine with two bases at once, and form what are called *triple salts*. Thus *tartaric acid* combines at once with *potash* and *soda*. Some salts combine with an additional dose of their acid, and others with an additional dose of their base. The first render vegetables blue, the second usually render them green. The first kind of salts are distinguished by prefixing to the usual name the preposition *super*, the second by prefixing the preposition *sub*. Thus *sulphate of potash*, denotes the salt in a state of perfect neutralization, without any excess either of acid or potash; *supersulphate of potash* is the same salt with an excess of acid; *subsulphate* of potash is the same salt with an excess of base.

As the different genera are denominated from the acids, it is obvious that there must be as many genera as there are acids. The termination of the names of these genera differs according to the acid which constitutes them. When the acid contains a maximum of oxygen, the termination of the genus is *ate*;

when it does not contain a maximum of oxygen, the termination of the genus is *ite*. Thus the salts which contain *sulphuric acid* are called *sulphates*; those which contain *sulphurous acid* are called *sulphites*. This distinction is of some consequence, because the salts differ very much according as the acid is saturated with oxygen or not. The *ites* are seldom permanent; when exposed to the air, they usually attract oxygen, and are converted into *ates*.

Every particular species of salt is distinguished by subjoining to the generic term the name of its base. Thus the salt composed of sulphuric acid and soda, is called *sulphate of soda*. Triple salts are distinguished by subjoining the names of both the bases connected by hyphens. Thus the salt composed of tartaric acid, potash, and soda, is called *tartrate of potash-and-soda*. Sometimes, instead of this, one of the bases is prefixed to the name by way of adjective. Thus, *soda-muriate of rhodium* means the triple salt composed of muriatic acid, soda, and the oxide of rhodium. Sometimes the name of the base prefixed is altered a little; as, *ammonia-sulphate of magnesia* (*sulphate of magnesia-and-ammonia*); *ferruginous sulphate of zinc* (*sulphate of zinc-and-iron.*)

The salts naturally divide themselves into two classes. Those which contain an alkali or earth for their base, derive their chief properties from the acids, and are properly enough characterised by the name of the acids applied to the names of the genera. But those which have for their base a metallic oxide, derive their characteristic properties from that base, and ought therefore to be arranged according to it. We shall therefore divide this Chapter into two Sections; in the first, we shall treat of the salts with alkaline and earthy bases; in the second, of the salts with metallic bases.

SECT. I. *Of Alkaline and Earthy Salts.*

Alkaline and earthy salts.

As the genera of these salts (derived from their acids) are very numerous, it will be advantageous to the learner, if we subdivide them into sets according to their properties. This is attempted in the following Table.

I. Incombustible Salts.
  a. Not altered when heated with charcoal.
    1. Muriates.
    2. Fluates.
    3. Borates.
    4. Phosphates.*
  b. Decomposed without combustion when heated with charcoal.
    1. Sulphates.
    2. Carbonates.
  c. Set fire to charcoal, or yield oxygen gas by heat.
    1. Nitrates.
    2. Nitrites.
    3. Hyper-oxymuriates.
    4. Arseniates.
    5. *Molybdates.*
    6. *Tungstates.*
    7. *Chromates.*
    8. *Columbates.*†
II. Combustible Salts.
  a. Acids partially dissipated by heat, leaving salts in *ate*.
    1. Sulphites.
    2. Phosphites.
  b. Acids entirely dissipated by heat, leaving the base and charcoal.
    + Acids partly sublimed unaltered.
    1. Acetates.
    2. Succinates.
    3. Moroxylates.
    4. Benzoates.
    5. Camphorates.
    ++ Acids wholly decomposed.
    6. Oxalates.
    7. Mellates.
    8. Tartrates.
    9. Citrates.
    10. Kinates.
    11. Saccolates.
    12. Urates.
    13. Sebates.
    14. Malates.
    15. Formiates.
    16. Suberates.
    +++ Anomalous.
    17. Gallates.
    18. Prussiates.

Let us take a view of these genera in their order.

GENUS I. *Muriates.*

Muriates.

The muriates are all soluble in water, and several of them likewise in alcohol. When mixed with sulphuric acid they effervesce, and white acrid fumes with the odour of muriatic acid are exhaled.

We are but imperfectly acquainted with these bodies. Many of the compounds hitherto considered as muriates, have been shewn by Mr Davy to be compounds of chlorine, and a metallic body. Thus *common salt* is a compound of chlorine and sodium. The following are the only salts which we know at present to be muriates.

Sp. 1. *Muriate of Ammonia.* This salt was named *sal ammoniac*, because it was found native near the temple of Jupiter Ammon in Africa. It is usually in the form of hard elastic cakes. But by solution and evaporation it may be obtained crystallized in long four-sided pyramids. It deliquesces a little when exposed to moist air. It is soluble in about thrice its weight of water, and in about 75 parts of alcohol. When heated, it sublimes without decomposition, in a white smoke.

Sp. 2. *Muriate of Magnesia.* This salt exists in sea-water. It is not easily crystallized, but when its solution, properly concentrated, is exposed to a sudden cold, it may be obtained in small needles. Its taste is very bitter, hot, and biting. It dissolves in about half its weight of water, and in about twice its weight of pure alcohol. When exposed to the air, it speedily deliquesces. A strong heat decomposes it. When dried in a high temperature, it is very caustic.

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* The phosphates are decomposed when violently heated with charcoal, but the temperature required is so high that the decomposition cannot be effected in ordinary fires. Except the phosphate of ammonia, which is decomposed pretty easily.

† The nitrate and hyperoxymuriate of ammonia are combustible alone. They are completely dissipated when heated. The genera in italics are placed from analogy only.

Sp. 3. *Muriate of Ammonia-and-Magnesia.* This salt is obtained when the solutions of the two last salts are mixed together. Its crystals are small and irregular, its taste bitter and ammoniacal. It dissolves in about six times its weight of cold water.

Sp. 4. *Muriate of Alumina.* This salt is always in the state of a supermuriate. It hardly crystallizes, being always either gelatinous or in the state of a white mass. Water dissolves about four times its weight of it. It speedily deliquesces in the air. Alcohol dissolves at least half its weight of this salt. When heated, it melts and loses its acid.

Sp. 5. *Muriate of Yttria.* This salt does not crystallize, but runs to a jelly. It melts in a gentle heat, and attracts moisture very rapidly from the atmosphere.

Sp. 6. *Muriate of Glucina.* This salt has a sweet taste, and readily crystallizes.

Sp. 7. *Muriate of Zirconia.* This salt is transparent, and crystallizes in needles, which effloresce in the air. It is very soluble in water and in alcohol. Heat decomposes it with facility.

The following Table exhibits the composition of these salts according to the most accurate experiments hitherto made:

Muriates of	Constituents.		
	Acid.	Base.	Water.
Ammonia	100	64.6	75.4
Magnesia	100	89.8	99.3
Alumina	100	100	135

The last species has not hitherto been analysed.

Genus II. *Fluates.*

Fluates.

Most of these salts are but sparingly soluble in water, and hitherto they have been but superficially examined. When sulphuric acid is poured on them, they exhale acrid fumes, which readily act upon glass and corrode it.

Sp. 1. *Fluate of Potash.* This salt is hardly known. It is said to crystallize when pure. It has but little taste, dissolves readily in water, and melts when heated. It combines readily with silica, and forms a white powder, loose like chalk, containing an excess of acid.

Sp. 2. *Fluate of Soda.* This salt crystallizes in cubes. Its taste is bitter and astringent. It is sparingly soluble in water. When heated, it decrepitates and melts into a transparent globule.

Sp. 3. *Fluate of Ammonia.* This salt crystallizes, and may be sublimed without decomposition.

Sp. 4. *Fluate of Alumina.* This salt does not crystallize, but is easily obtained in the state of a jelly. Its taste is astringent, and it always contains an excess of acid.

The remaining fluates are insoluble in water.

Sp. 5. *Fluate of Magnesia.* When this salt contains an excess of acid, it may be obtained in dodecahedrons. Heat does not decompose this salt.

Sp. 6. *Fluate of Lime.* This salt occurs native in abundance, and is the only fluate that has been accurately examined. It is usually crystallized in cubes, sometimes in octahedrons. It has no taste, nor is it altered by exposure to the air. Its specific gravity is 3.15. When heated, it decrepitates and phosphoresces strongly. When strongly heated, it melts into transparent glass. According to Dr Thomson's analysis, it is composed of 32⅔ acid and 67⅓ lime.

Sp. 7. *Fluate of Barytes.* This is a white tasteless powder, not hitherto examined.

Sp. 8. *Fluate of Alumina-and-Soda.* This salt has been found in Greenland, and is called *cryolite* by mineralogists. Its colour is greyish white. It has some transparency. It breaks into cubic fragments. Its specific gravity is 2.950. It is brittle and softer than fluate of lime. It is composed of

Acid and water,	40
Soda,	36
Alumina	24
	100

Sp. 9. *Fluate of Silica.* Fluoric acid, as usually obtained, contains, in solution, a quantity of silica. When kept in vessels not completely shut, it deposites small rhomboidal crystals of silica.

Genus III. *Borates.*

Borates.

This genus has been very imperfectly examined. All the fluates, before the blow-pipe, melt into a glass. When boiled in diluted sulphuric acid, they yield small scales of boracic acid.

Sp. 1. *Borate of Potash.* This salt crystallizes in four-sided prisms. It has been very little examined.

Sp. 2. *Borate of Soda.* This salt may be formed by saturating borax with boracic acid. It is soluble in 2½ times its weight of hot water.

Sp. 3. *Borax* or *Sub-borate of Soda.* This salt is the only one of the borates which has been accurately examined. It is brought from the East Indies, and has been in common use in Europe for ages. It seems even to have been known to the ancients. It crystallizes in hexangular prisms, but is usually in roundish semi-transparent lumps. Colour white. Specific gravity 1.740. Taste styptic and alkaline. Converts vegetable blues to green. Soluble in about twenty times its weight of cold water, but more soluble in hot water. When exposed to the air, it effloresces slowly and slightly. When heated, it melts, loses its water of crystallization, and is converted into a light porous substance called *calcined borax.* In a strong heat it melts into a transparent glass, still soluble in water. It is said to be composed of

Acid,	39
Base,	17
Water,	44
	100

Sp. 4. *Borate of Ammonia.* This salt forms permanent crystals, which resemble those of borax. Heat decomposes it.

Sp. 5. *Borate of Strontian.* This salt is a white powder, and contains an excess of base.

The remaining borates are insoluble in water.

Sp. 6. *Borate of Magnesia.* This salt may be obtained in small irregular crystals. It is soluble in acetic acid. Alcohol is said to decompose it. When heated, it melts, and is not decomposed.

Sp. 7. *Borate of Lime.* This is a white powder, hardly soluble in water, and tasteless.

Sp. 8. *Borate of Barytes.* An insoluble white powder, hardly examined.

Sp. 9. *Borate of Alumina.* Scarcely soluble, and not crystallizable.

GENUS IV. *Phosphates.*

Phosphates.

The salts belonging to this genus, when heated before the blowpipe, melts into a globule of glass. They dissolve in nitric acid, without effervescence, and are precipitated from that solution by lime-water or ammonia. They amount to twelve.

Sp. 1. *Phosphate of Potash.* Of this salt there are two varieties, the *superphosphate*, long known, and the *phosphate*, not accurately discriminated till lately.

Variety 1. *Superphosphate.* This salt is formed by dissolving carbonate of potash in phosphoric acid till all effervescence cease, and then evaporating the solution. It crystallizes with difficulty in striated prisms. It is very soluble in water, and deliquesces when exposed to the air. When heated, it undergoes the watery fusion, loses its water of crystallization, and is reduced to dryness. In a high temperature it melts into a transparent glass.

Variety 2. *Phosphate.* This salt may be formed by saturating the superphosphate with potash, and exposing the mixture to heat in a platinum crucible. It is usually in the state of a white powder, tasteless, and insoluble in cold water though it dissolves in hot water. It melts easily into a transparent bead, which becomes opake on cooling. It dissolves in the nitric, muriatic, and phosphoric acids, and is not precipitated by alkalies; but when the solutions are concentrated, a precipitate falls.

Sp. 2. *Phosphate of Soda.* This salt is usually prepared by decomposing the superphosphate of lime from burnt bones with carbonate of soda. As sold by apothecaries, it is much contaminated by sulphate of soda. It crystallizes in rhomboidal prisms. Its taste is similar to that of common salt. It dissolves in four times its weight of cold water. In the air it effloresces. When heated, it undergoes the watery fusion; and, at a red heat, melts into a white enamel.

Sp. 3. *Phosphate of Ammonia.* This salt exists in urine. It is also prepared artificially in the same way as the last species. It crystallizes in four-sided prisms. Its taste is cooling, salt, and ammoniacal. It is soluble in four parts of cold water. When heated, it undergoes the watery fusion. In a strong heat the ammonia is disengaged, and the phosphoric acid melts into a glass.

Sp. 4. *Phosphate of Magnesia.* This salt may be obtained by mixing together concentrated solutions of phosphate of soda and sulphate of magnesia; in a few hours crystals of phosphate of magnesia are deposited. It crystallizes in six-sided prisms with unequal sides. It has little taste, dissolves in 15 parts of cold water, and falls to powder when exposed to the air. When heated strongly, it melts into a transparent glass.

Sp. 5. *Phosphate of Soda-and-Ammonia.* This salt, known by the name of *microcosmic salt*, may be obtained from urine. It possesses nearly the properties of a mixture of the two preceding species.

Sp. 6. *Phosphate of Ammonia-and-Magnesia.* This triple salt exists also in urine. Its crystals are four-sided transparent prisms, terminated by four-sided pyramids. It is tasteless; scarce soluble in water; and not liable to be altered by exposure to the air. In a strong heat, it loses its ammonia, and melts into a transparent glass.

The remaining phosphates are insoluble in water.

Sp. 7. *Phosphate of Lime.* This salt constitutes the basis of bones. It may be obtained by calcining bones, dissolving them in muriatic acid, and precipitating by ammonia. It is then in the state of a white powder; but it is found native, crystallized in six-sided prisms, and is distinguished among mineralogists by the name of *apatite*. It has no taste, is insoluble in water, and not altered by exposure to the air. A red heat does not alter it; but in a very violent temperature, it is converted into a kind of enamel. It dissolves in the strong acids without effervescence, and may be again precipitated by ammonia. The strong mineral acids decompose it partially, and convert it into *superphosphate of lime*, which is an acid liquid, which crystallizes in thin brilliant plates.

Sp. 8. *Phosphate of Barytes.* This is a white tasteless powder, which, in a violent temperature, melts into a grey enamel.

Sp. 9. *Phosphate of Strontian.* This is a white powder, insoluble in water, but soluble in phosphoric acid. Before the blowpipe, it fuses into a white enamel.

Sp. 10. *Phosphate of Alumina.* A white powder, but tasteless and insoluble in water.

Sp. 11. *Phosphate of Yttria.* A gelatinous mass, insoluble in water.

Sp. 12. *Phosphate of Glucina.* A white tasteless insoluble powder.

The following Table exhibits the constituents of the phosphates, according to the experiments of Richter.

Phosphate of	Acid.	Base.
Alumina	100	53.6
Magnesia	100	62.8
Ammonia	100	68.6
Lime	100	81
Soda	100	87.7
Strontian	100	135.7
Potash	100	164
Barytes	100	222

GENUS V. *Phosphites.*

Phosphites.

The salts belonging to this genus have been but little examined by chemists. When heated, they emit a phosphorescent flame. When strongly heated, they yield a little phosphorus, and are converted into *phosphates*.

Sp. 1. *Phosphite of Potash.* This salt crystallizes in four-sided prisms. Its taste is sharp and saline. It is soluble in three parts of cold water. It is not altered by exposure to the air.

Sp. 2. *Phosphite of Soda.* It crystallizes in rhomboids. Its taste is cooling and agreeable. It dissolves in two parts of cold water. It effloresces in the air. Before the blow-pipe, it gives out a fine yellow flame, and melts into a globule which becomes opake in cooling.

Sp. 3. *Phosphite of Ammonia.* It crystallizes in four-sided prisms. Its taste is sharp and saline. It dissolves in two parts of cold water. It deliquesces a little. When heated, it loses its base; emits phosphureted hydrogen gas, and phosphoric acid remains.

Sp. 4. *Phosphite of Ammonia-and-Magnesia.* This salt is sparingly soluble in water, and crystallizes.

Sp. 5. *Phosphite of Alumina.* This salt does not crystallize, but forms a glutinous mass, which dries gradually, and does not afterwards attract moisture. It is very soluble in water. Its taste is astringent.

The remaining phosphites are insoluble in water.

Sp. 6. *Phosphite of Magnesia.* This salt is usually in the state of a white powder, or of small four-sided prisms. It effloresces in the air. It is said to be soluble in 400 parts of cold water.

Sp. 7. *Phosphite of Lime.* This is a white tasteless powder, insoluble in water, but soluble in phosphorous acid, forming a superphosphite, which may be obtained in prismatic crystals by evaporation.

Sp. 8. *Phosphite of Barytes.* This is a white powder, hardly soluble in water unless there be an excess of acid.

GENUS VI. *Carbonates.*

Carbonates.

This is one of the most important of the saline genera. When muriatic or nitric acid is poured on them, they effervesce, and give out carbonic acid. When fully saturated, they do not affect vegetable blues, but the alkaline *subcarbonates* convert vegetable blues to green.

Sp. 1. *Carbonate of Potash.* Of this salt there are two varieties, the *carbonate* and *subcarbonate*.

Variety 1. *Carbonate.* This salt may be formed by causing a current of carbonic acid to pass through a solution of potash, till the salt crystallizes. It crystallizes in rhomboidal prisms, with dihedral summits. It has a very slight alkaline taste, and still gives a green colour to vegetable blues. It is soluble in four parts of cold water. Alcohol scarcely dissolves it. Exposure to air does not alter it.

Variety 2. *Subcarbonate.* This salt is obtained by exposing the preceding to a strong red heat. It contains exactly one half of the acid contained in the carbonate. It is much more soluble in water; its taste is very alkaline and caustic; and when exposed to the air, it soon deliquesces and runs into a liquid. The potash of commerce is always in the state of a subcarbonate.

Sp. 2. *Carbonate of Soda.* Of this salt, like the preceding, there are two varieties.

Variety 1. *Carbonate.* This salt occurs native in Africa, and may be formed by passing a current of carbonic acid through a solution of soda, till it ceases to absorb any more. It runs into a hard solid mass, which is not altered by exposure to the air.

Variety 2. *Subcarbonate.* What is called carbonate of soda in commerce, is nothing else than this salt. Its crystals are octahedrons, having their apexes truncated, or more commonly flat rhomboidal prisms. It dissolves in two parts of cold water. When exposed to the air, it effloresces and falls to powder. When heated, it undergoes the watery fusion, and melts in a red heat into a transparent liquid.

Sp. 3. *Carbonate of Ammonia.* Of this salt, also, there are at least two varieties.

Variety 1. *Carbonate.* This salt may be obtained by passing a current of carbonic acid through the subcarbonate dissolved in water. It crystallizes in six-sided prisms; has no smell, and much less taste than the subcarbonate. When heated, it sublimes, and is decomposed.

Variety 2. *Subcarbonate.* This salt crystallizes, but the crystals are small and irregular. Its smell and taste are similar to those of ammonia, though weaker. It is lighter than water. It is soluble in less than twice its weight of water. From the experiments of Davy, it would appear that there are different varieties of this salt, containing various proportions of acid, according to the temperatures in which it has been prepared.

Sp. 3. *Carbonate of Ammonia-and-Magnesia.* This salt may be formed by mixing together aqueous solutions of its two constituents. Its properties have not been examined.

The remaining carbonates are insoluble in water.

Sp. 5. *Carbonate of Magnesia.* Of this salt there are likewise two varieties.

Variety 1. *Subcarbonate.* This is a light white powder, constituting the magnesia of commerce.

Variety 2. *Carbonate.* It may be formed by diffusing the preceding variety in water, and passing a current of carbonic acid through the liquid. It crystallizes in six-sided transparent prisms. It has little taste. It dissolves, when in crystals, in 48 parts of cold water. It effloresces in the air, and falls to powder.

Sp. 6. *Carbonate of Lime.* This salt, under the names of marble, chalk, limestone, calcareous spar, &c. exists in great abundance in nature. It crystallizes in rhomboidal prisms, with angles of 101½° and 78½°; and no less than 616 different varieties of form have been observed and described by mineralogists. It is tasteless, insoluble in water, but soluble in a small proportion by means of carbonic acid. When heated strongly, it loses its acid, and the escape of the acid is greatly facilitated by the presence of vapour. When suddenly heated, it melts without losing its acid, and assumes a form bearing some resemblance to granular limestone.

Sp. 7. *Carbonate of Barytes.* This salt is found native, and distinguished by mineralogists by the name of Witherite. It crystallizes in double six-sided and four-sided pyramids. It is tasteless, insoluble in water, but poisonous. It is not altered by exposure to the air. When made up into a ball with charcoal, and violently heated, it loses its acid.

Sp. 8. *Carbonate of Strontian.* This salt also occurs native, usually in semi-transparent striated masses, with a greenish tinge. It is tasteless, insoluble in water, and not altered by exposure to the air. When violently heated, it loses its acid.

Sp. 9. *Carbonate of Alumina.* Water, containing carbonic acid gas, dissolves a little alumina; but when the alumina is precipitated and dried, it appears, from the experiments of Saussure, that it loses its acid. Carbonate of alumina, then, cannot exist in a dry state.

Sp. 10. *Carbonate of Yttria.* A white, tasteless, insoluble powder.

Sp. 11. *Carbonate of Glucina.* A white, soft, tasteless powder, with greasy feel.

Sp. 12. *Carbonate of Zirconia.* A white tasteless powder.

The following Table exhibits a view of the composition of these salts, as far as it has been ascertained.

Carbonate of	Acid.	Base.	Water.
Ammonia, ...	100	33.9	44.6
Magnesia, ...	100	50	50
Potash, ...	100	95.3	37
Soda, ...	100	97.4	59
Lime, ...	100	122	
Strontian, ...	100	231	
Yttria, ...	100	305.5	150
Barytes, ...	100	363	

The subcarbonates appear to contain just one half of the acid which exists in the carbonates.

GENUS VII. *Sulphates.*

Sulphates.

This genus of salts has been long known, and very carefully examined. Most of the salts in it crystallize. Their taste is usually bitter. They are insoluble in alcohol, and precipitated from water by alcohol. When heated to redness, along with charcoal, they are converted into sulphurets. All their solutions yield a white precipitate, insoluble in cold sulphuric acid, when mixed with muriate of barytes.

Sp. 1. *Sulphate of Potash.* Of this salt there are two varieties.

Variety 1. *Sulphate.* This salt is usually to be found in considerable quantity in the potash of commerce. The crystals are small, irregular, hard, and firm: usually six-sided prisms. The taste is a disagreeable bitter. It dissolves in about 16 times its weight of cold water. It is not altered by exposure to the air. In a red heat it melts, and loses about 1⅓ per cent. of its weight.

Variety 2. *Supersulphate.* This salt may be obtained by dissolving the preceding in sulphuric acid, and evaporating. Its crystals are long slender needles, or six sided prisms. Its taste is acid, and it reddens vegetable blues. When heated, it melts, and assumes the appearance of oil. A strong red heat is necessary to drive off the excess of acid, and convert it into *sulphate*.

Sp. 2. *Sulphate of Soda.* This salt is often called Glauber's salt from the name of the discoverer of it. There are two varieties of it, like the preceding.

Variety 1. *Sulphate.* This salt crystallizes in six-sided transparent prisms, terminated by dihedral summits. The sides of the prisms are usually channelled. Its taste, at first, has some resemblance to that of common salt, but it soon becomes disagreeably bitter. It dissolves in less than thrice its weight of cold water, and in less than its weight of boiling water. When exposed to the air, it loses its water, effloresces, and falls to powder. The loss of weight is about 0.56 parts. When heated, it undergoes the watery fusion. In a read heat it melts, and, according to Kirwan, loses part of its acid.

Variety 2. *Supersulphate.* This salt may be obtained by dissolving the preceding variety in sulphuric acid, and evaporating the solution. It crystallizes in large transparent rhombs, which effloresce in the air, and easily part with their excess of acid.

Sp. 3. *Sulphate of Ammonia.* This salt crystallizes in small six-sided prisms. It has a sharp bitter taste; is soluble in twice its weight of cold water, and in its weight of boiling water. When exposed to the air, it slowly attracts moisture. When heated, it decrepitates, then melts, and sublimes with some loss of its alkali. When heated nearly to redness, the greatest part of it is decomposed.

Sp. 4. *Sulphate of Magnesia.* This salt was long known by the name of *Epsom salt,* because it exists in the spring at Epsom near London. It exists also in sea water. It crystallizes in regular four-sided prisms, surmounted by four-sided pyramids or dihedral summits. The crystals refract doubly. Its taste is intensely bitter. It dissolves in its own weight of cold water. In the air it effloresces. When heated, it undergoes the watery fusion, and before the blowpipe melts with difficulty into an opake vitreous globule.

Sp. 5. *Sulphate of Potash-and-Ammonia.* This salt crystallizes in brilliant plates. Its taste is bitter, and it is not altered by exposure to the air.

Sp. 6. *Sulphate of Potash-and-Magnesia.* This salt crystallizes in rhomboidal prisms, and is not altered by exposure to the air.

Sulphate of Soda is also capable of forming triple salts with ammonia and magnesia.

Sp. 7. *Sulphate of Magnesia-and-Ammonia.* This salt crystallizes in octahedrons. Its taste is acrid and bitter. It is decomposed by heat, and is less soluble in water than either of its constituents.

Sp. 8. *Sulphate of Alumina.* This salt crystallizes in thin plates, soft and pliant, and of a pearly lustre. Its taste is astringent. It is very soluble in water, and crystallizes with difficulty.

Sp. 9. *Alum.* This is a triple salt, of which there are four varieties, namely, 1. *Sulphate of alumina-and-potash*; 2. *Sulphate of alumina-and-ammonia*; 3. *Supersulphate of ammonia-and-potash*; 4. *Supersulphate of alumina-and-ammonia.* The two last, (especially the 3d,) constitute the *alum* of commerce; the two first have been called *alum saturated with its earth,* or *aluminated alum.*

The composition of common alum was first ascertained by Vauquelin. It crystallizes in regular octahedrons. It is white, and semitransparent. Its taste is sweetish and astringent, and it reddens vegetable blues. It dissolves in about 16 parts of cold water. In a gentle heat, it undergoes the watery fusion, and by continuing the heat, it loses about 44 per cent. of water, and is called *calcined* or *burnt alum*. In a violent heat, a portion of the acid is converted into sulphurous acid, and oxygen gas. This salt, according to the analysis of Vauquelin, is usually composed of

Sulphuric acid,	30.52
Alumina, ...	10.50
Potash, ...	10.40
Water, ...	48.58
	100.00

Alum sometimes contains a little sulphate of iron mixed with it, which injures its qualities as a mordant.

The *sulphates*, or two first varieties, may be formed by boiling alumina in a solution of alum. They are tasteless powders, insoluble in water, and not altered by exposure to the air.

Sp. 10. *Sulphate of Yttria.* This salt crystallizes in flat six-sided prisms. It is not altered by exposure to the air. Its taste is astringent and sweet. It has an amethyst red colour, and dissolves in about 30 parts of cold water. At a red heat it is perfectly decomposed.

Sp. 11. *Sulphate of Glucina.* This salt is colourless. It crystallizes in needles. Its taste is very sweet, and somewhat astringent. It is very soluble in water, and the solution does not readily crystallize. When heated, it undergoes the watery fusion, and in a red heat, is completely decomposed.

Sp. 12. *Sulphate of Zirconia.* This salt is usually in the form of a white powder; though it may be obtained also crystallized in needles. It is tasteless, and insoluble in water; not altered by exposure to the air, and easily decomposed by heat.

Sp. 13. *Sulphate of Lime.* This salt occurs native, and is distinguished by the names of *gypsum* and *selenite*. It is found crystallized in octahedrons, six-sided prisms, and in lenses. It has little or no taste. It dissolves in about 460 parts of cold water. It is not altered by exposure to the air. It dissolves in sulphuric acid. When heated, it loses its water of crystallization. When mixed with a little lime, it is much used under the name of *plaster of Paris*, for forming casts, moulds, &c.

Sp. 14. *Sulphate of Barytes.* This salt is found native, and distinguished by the names of *ponderous spar, heavy spar, baroselenite.* It occurs crystallized in tables, with bevelled edges, in four sided prisms, &c. It is white, tasteless, insoluble in water, but soluble in hot sulphuric acid. It melts, when strongly heated, into a white opake globule. When made into a cake with flour, and heated to redness, it is phosphorescent.

Sp. 15. *Sulphate of Strontian.* This salt, like the preceding, occurs native in considerable quantity. It is crystallized in rhomboidal prisms. It is white, tasteless, insoluble in water, but soluble in hot sulphuric acid. In most of its properties it resembles the preceding salt, but its specific gravity is much less. The specific gravity of sulphate of barytes is at least 4.3, while that of sulphate of strontian does not exceed 3.66.

The following table exhibits the composition of the different sulphates, as far as it has been ascertained.

Sulphate of	Acid.	Base.	Water.
Ammonia	100	26.05	57
Magnesia	100	47.36	182.8
Lime	100	72.41	55.8
Soda	100	79.34	246.6
Potash	100	112.35	20
Strontian	100	138	
Barytes	100	194	

Genus VIII. *Sulphites.*

Sulphites.

The sulphites may be formed by passing a current of sulphurous acid gas through water, holding the different bases in solution or suspension. They have a disagreeable sulphureous taste. When heated, they emit sulphurous acid and water, and at last sulphur, and are converted into sulphates. When they are exposed to the air in a state of solution, they are also gradually converted into sulphates.

Sp. 1. *Sulphite of Potash.* This salt crystallizes in rhomboidal plates, white, and semitransparent. Its taste is penetrating and sulphureous. It dissolves in its own weight of cold water. In the air it loses about two per cent. of its weight, and is very slowly altered; at least in six months it still contained nearly the usual proportion of sulphurous acid. Nitric acid speedily converts it into sulphate of potash.

Sp. 2. *Sulphite of Soda.* This salt crystallizes in flat four-sided prisms. It is white and transparent. Its taste is cool and sulphureous. It dissolves in four times its weight of cold water. In the air it effloresces, and is converted into sulphate. When heated it undergoes the watery fusion.

Sp. 3. *Sulphite of Ammonia.* It crystallizes in six-sided prisms. Its taste is cool and penetrating, and it leaves a sulphureous impression in the mouth. It dissolves in its own weight of cold water. When exposed to the air it attracts moisture, and is soon converted into sulphate. When heated, a little ammonia is disengaged, and the salt then sublimes in the state of *supersulphite of ammonia.*

Sp. 4. *Sulphite of Magnesia.* It crystallizes in the form of depressed tetrahedrons. It is white and transparent. Its taste is mild, but it leaves a sulphureous impression in the mouth. When exposed to the air, it becomes opake, and is very slowly converted into sulphate. It dissolves in 20 parts of cold water. When heated, it becomes ductile like gum, and loses 45 per cent. of its weight.

Sp. 5. *Sulphite of Ammonia-and-Magnesia.* This salt crystallizes, and is less soluble in water than either of its constituents.

Sp. 6. *Sulphite of Lime.* This salt is in the state of a white powder, or if an excess of acid be added, it crystallizes in six-sided prisms, terminated by six-sided pyramids. It has little taste, dissolves in about 800 parts of water, and in the air effloresces very slowly, its surface being changed into sulphate.

Sp. 7. *Sulphate of Barytes.* This salt, like the preceding, may be obtained in crystals, by adding an excess of acid. It crystallizes in needles. It is tasteless, and nearly insoluble in water.

Sp. 8. *Sulphite of Alumina.* This salt does not crystallize. It is a white soft powder, with an earthy and sulphureous taste. It is insoluble in water, and when exposed to the air, it is slowly converted into sulphate.

The following Table exhibits the constituents of the sulphites, as far as they have been ascertained.

Sulphites of	Acid.	Base.	Water.
Magnesia	100	41	115
Ammonia	100	48.3	18.3
Soda	100	58	164
Lime	100	97.9	10.5
Potash	100	125	4.6
Alumina	100	137.5	75
Barytes	100	151	5.1

GENUS IX. *Nitrates.*

Nitrates.

All the salts belonging to this genus are soluble in water, and crystallize by cooling. When heated to redness, and charcoal powder thrown over them, a violent combustion is produced. Sulphuric acid disengages from them fumes of nitric acid. When heated, they are decomposed, and yield at first oxygen gas.

Sp. 1. *Nitrate of Potash, or Nitre.* This salt, which is of great importance, is found in warm climates, on the surface of the earth. It is collected and purified by solution and crystallization. Its crystals are six-sided prisms, terminated by six-sided pyramids. Its taste is sharp, bitterish, and cooling. It is very brittle. It dissolves in seven parts of cold water, and in less than its own weight of boiling water. Pure alcohol does not dissolve it. In a red heat it melts and congeals into an opake mass, which has been called *mineral crystal.* When kept melted, it gives out about the third of its weight of oxygen gas. It detonates most violently with charcoal. This salt constitutes the principal ingredient of gunpowder, which is a mixture of about 76 parts nitre, fifteen charcoal, and nine sulphur. The constituents are ground to a fine powder, and then mixed together with great care. The goodness of the powder depends upon the intimate mixture. Those kinds of charcoal are pitched upon which absorb the least moisture from the air.

Sp. 2. *Nitrate of Soda.* This salt crystallizes in transparent rhombs, differing but little from cubes. It has a cool sharp taste, and is rather more bitter than nitre. It dissolves in three parts of cold water, and in less than its weight of boiling water. When exposed to the air, it rather attracts moisture. Its phenomena with combustibles and heat are the same as those of the preceding species.

Sp. 3. *Nitrate of Ammonia.* This salt crystallizes in six-sided prisms, terminated by six-sided pyramids. It has a very acrid, bitter, disagreeable taste. It dissolves in twice its weight of cold water, and in half its weight of boiling water. In the air it very speedily deliquesces. When heated, it undergoes the watery fusion; but even after the water is driven off, it continues liquid at the temperature of about 400°, boils, and is decomposed, being converted into water and *nitrous oxide* gas, in the proportion of about four parts gas to three parts water. When heated nearly to redness, it burns with a kind of explosion. Hence it was formerly called *nitrum flammans.*

Sp. 4. *Nitrate of Magnesia.* This salt crystallizes in rhomboidal prisms, or small needles. Its taste is very bitter and disagreeable. It is soluble in little more than its weight of cold water. In the air it deliquesces. When heated, it undergoes the watery fusion, and speedily assumes the form of a white powder. It scarcely detonates with combustible bodies.

Sp. 5. *Nitrate of Lime.* This salt crystallizes in six-sided prisms, terminated by long pyramids. Its taste is very acrid and bitter. It dissolves in about the fourth part of its weight of cold water, and boiling water dissolves any quantity of it whatever. Boiling alcohol dissolves its own weight of it. It speedily deliquesces in the air. When heated, it readily undergoes the watery fusion. When deprived of its water of crystallization, it often has the property of shining in the dark. In this state it is called *Baldwin's phosphorus.*

Sp. 6. *Nitrate of Barytes.* This salt crystallizes in regular octahedrons, or in small brilliant plates. Its taste is hot, acrid, and austere. It is soluble in about twelve parts of cold water. When thrown upon burning coals, it decrepitates, and is converted into a dry mass. When strongly heated, the whole of its acid is dissipated, and pure barytes obtained.

Sp. 7. *Nitrate of Strontian.* This salt crystallizes in regular octahedrons, not unlike the crystals of nitrate of barytes. It has a strong, pungent, cooling taste. It is soluble in its own weight of cold water, and in little more than half its weight of boiling water. It is insoluble in alcohol. It deflagrates on hot coals. In a crucible it melts when heated. At a red heat it gives out its acid, and pure strontian remains behind. Combustibles thrown into it when red hot, burn with a lively red flame.

Sp. 8. *Nitrate of Ammonia-and-magnesia.* This salt crystallizes in fine prisms. It has a bitter, acrid, ammoniacal taste. It dissolves in about eleven parts of cold water. In the air it gradually attracts moisture, and deliquesces.

Sp. 9. *Nitrate of Alumina.* This salt crystallizes with difficulty into thin soft plates, which have but little lustre. It has an acid and astringent taste, is very soluble in water, and soon deliquesces when exposed to the air. When evaporated, it is readily converted into a gummy mass, of the consistence of honey. It is easily decomposed by heat.

Sp. 10. *Nitrate of Yttria.* This salt scarcely crystallizes. Its taste is sweet and astringent. It speedily deliquesces in the air.

Sp. 11. *Nitrate of Glucina.* This salt may be obtained in the state of a powder, but not in crystals. Its taste is sweet and astringent. It is very soluble in water, and speedily deliquesces in the air.

Sp. 12. *Nitrate of Zirconia.* This salt does not crystallize, but may be obtained in the state of a viscid mass, which dries with difficulty. It has an astringent taste. It is very sparingly soluble in water, and seems, indeed, to be partially decomposed by that liquid. When heated, it readily parts with its acid, and is decomposed.

The following Table exhibits the composition of the nitrates, as far as has been ascertained.

Nitrate of	Acid.	Base.	Water.
Ammonia	100	40.38	35.1
Magnesia	100	47.64	
Lime	100	55.70	18.7
Soda	100	73.43	
Strontian	100	116.86	105.3
Potash	100	117.7	8.1
Barytes	100	178.12	34.3

GENUS X. *Nitrites.*

Nitrites.

When the crystallized nitrates are exposed to a sufficient heat, they give out oxygen gas. If the process be stopped in time, the salts still continue neutral. But the nature of the acid is obviously changed, as it has lost oxygen. Hence by this process the nitrates are converted into nitrites. The properties of the nitrites have not hitherto been investigated, except the nitrite of potash, examined by Bergman and Scheele. It deliquesces when exposed to the air, and gives out nitrous fumes, when treated with any acid, even the acetic.

GENUS XI. *Hyperoxymuriates.*

Hyperoxymuriates.

This genus of salts was discovered by Berthollet. But except the first species, all the rest were nearly unknown till examined by Chenevix in 1802. They are formed by passing a current of oxymuriatic acid through the bases dissolved in water. When heated nearly to redness, they give out oxygen gas, and are converted into muriates. When mixed with combustibles and heated, triturated, or struck upon an anvil, they detonate with great violence.

Sp. 1. *Hyperoxymuriate of Potash.* This salt crystallizes in flat rhomboidal prisms, of a silvery whiteness. Its taste is cooling, austere, and disagreeable, somewhat analogous to that of nitre. It dissolves in 16 parts of cold, and 2½ of boiling water. It is not sensibly altered by exposure to the air. When heated nearly to redness, it gives out more than a third of its weight of oxygen gas. It detonates loudly when mixed with sulphur or phosphorus, and struck upon an anvil, or triturated in a mortar. The experiment ought not to be tried with more than a grain of the mixture. It may be made into gunpowder with sulphur and charcoal, but it is liable to explode during the preparation.

Sp. 2. *Hyperoxymuriate of Soda.* This salt is not easily obtained pure, because it is as soluble in water as the muriate of soda, with which it is mixed in the preparation. It crystallizes in cubes. It produces a sensation of cold in the mouth, and has a taste different from that of common salt. It dissolves in about three parts of cold water. In the air it deliquesces slightly. It dissolves in alcohol.

Sp. 3. *Hyperoxymuriate of Ammonia.* This salt may be formed by mixing carbonate of ammonia with an earthy hyperoxymuriate. It is very soluble in water and alcohol, and is decomposed at a moderate temperature.

Sp. 4. *Hyperoxymuriate of Magnesia.* This salt resembles the hyperoxymuriate of lime in its properties.

Sp. 5. *Hyperoxymuriate of Lime.* This salt may be formed by passing a current of oxymuriatic acid gas through lime diffused in water, and boiling phosphate of silver in the solution, filtering and evaporating. Its taste is sharp and bitter. It is very deliquescent, and dissolves copiously in alcohol.

Sp. 6. *Hyperoxymuriate of Barytes.* This salt may be obtained in the same way as the preceding species. It is soluble in four parts of cold water.

Sp. 7. *Hyperoxymuriate of Strontian.* This salt may be prepared like the preceding. It crystallizes in needles, deliquesces, and is soluble in alcohol.

The following Table exhibits a view of the constituents of the hyperoxymuriates, as far as has been ascertained.

Hyperoxymuriate of	Acid.	Base.	Water.
Magnesia	100	42.80	28.83
Soda	100	44.78	6.35
Lime	100	51.25	29.89
Strontian	100	56.52	60.87
Potash	100	67.24	4.30
Barytes	100	89.78	22.98

GENUS XII. *Arseniates.*

Arseniates.

When the salts belonging to this genus are heated along with charcoal powder, they are decomposed, and arsenic sublimes.

Sp. 1. *Arseniate of Potash.* This salt does not crystallize. It deliquesces, and changes vegetable blues to green. The *superarseniate of potash* is a transparent white salt, which crystallizes in four-sided prisms, terminated by four-sided pyramids. It is soluble in water, and gives a red colour to vegetable blues.

Sp. 2. *Arseniate of Soda.* This salt crystallizes in six-sided prisms. The superarseniate does not crystallize.

Sp. 3. *Arseniate of Ammonia.* This salt crystallizes in rhomboidal prisms. With an excess of acid it crystallizes in needles.

Sp. 4. *Arseniate of Magnesia.* This salt does not crystallize, but may be obtained in a solid gummy mass.

Sp. 5. *Arseniate of Lime.* This salt crystallizes, and is soluble in water.

Sp. 6. *Arseniate of Barytes.* This salt is insoluble in water, and cannot be crystallized.

Sp. 7. *Arseniate of Alumina.* This salt is a white powder insoluble in water.

Sp. 8. *Arseniate of Yttria.* This salt is likewise a white powder, which does not crystallize.

GENUS XIII. *Arsenites.*

Arsenites.

The term *arsenite* has been applied to the combinations of white oxide of arsenic with the salifiable bases. The alkaline arsenites are yellow-coloured masses with a nauseous odour, not crystallizable, formerly called *livers of arsenic.* The earthy arsenites are white powders nearly insoluble in water.

GENUS XIV. *Molybdates.*

Molybdates.

If into a solution of a molybdate a cylinder of tin with some muriatic acid be put, the liquid gradually assumes a deep blue colour.

Sp. 1. *Molybdate of Potash.* This salt crystallizes in small rhomboidal plates. It is bright, and has a metallic taste. It is soluble in hot water.

Sp. 2. *Molybdate of Soda.* This salt crystallizes, and is very soluble in water.

Sp. 3. *Molybdate of Ammonia.* This salt is soluble in water, and does not crystallize.

Sp. 4. *Molybdate of Magnesia.* This salt also is soluble in water, and does not crystallize.

Sp. 5. *Molybdate of Lime.* This is a white insoluble powder.

GENUS XV. *Tungstates.*

Tungstates.

These salts are combinations of yellow oxide of tungsten with the salifiable bases.

Sp. 1. *Tungstate of Potash.* This salt is soluble in water, deliquesces, and does not crystallize. Its taste is metallic and caustic.

Sp. 2. *Tungstate of Soda.* This salt crystallizes in elongated hexahedral plates. Taste acrid and caustic. Soluble in four parts of cold and two parts of boiling water.

Sp. 3. *Tungstate of Ammonia.* This salt crystallizes in needles or small plates. Its taste is metallic. It is soluble in water, and does not deliquesce.

Sp. 4. *Tungstate of Magnesia.* This salt crystallizes in small brilliant scales. It is soluble in water, and not altered by exposure to the air.

Sp. 5. *Tungstate of Lime.* This salt is found native. It is usually crystallized. The crystals are octahedrons. Colour yellowish grey, semi-transparent. It is insoluble in water, and not altered by exposure to the air.

Sp. 6 and 7. The tungstates of barytes and of alumina, are white insoluble powders scarcely examined.

GENUS XVI. *Chromates.*

Chromates.

This genus of salts has been but imperfectly examined. The salts have usually a yellow colour. The alkaline chromates and chromate of lime are soluble in water, and crystallize. Chromate of barytes appears to be insoluble.

GENUS XVII. *Columbates.*

Columbates.

This genus of salts has been very imperfectly examined. We know only the columbate of potash, which crystallizes in scales. Its taste is acrid and disagreeable.

ORDER II.

Combustible Salts.

GENUS I. *Acetates.*

Combustible Salts.

Acetates.

THE acetates are all soluble in water. Heat decomposes them, driving off and destroying the acid. When mixed with sulphuric acid and distilled, acetic acid comes over, easily distinguished by its smell.

Sp. 1. *Acetate of Potash.* This salt is usually obtained in plates, but it crystallizes regularly in prisms. It has a sharp warm taste. It deliquesces in moist air, but in dry air undergoes but little alteration. It is soluble also in alcohol. When heated it melts, and in a high temperature is decomposed.

Sp. 2. *Acetate of Soda.* This salt crystallizes in striated prisms, not unlike those of sulphate of soda. It has a sharp taste, inclining to bitter. It dissolves in rather less than three times its weight of cold water. It is not affected by exposure to the air. When heated it loses its water of crystallization, and is decomposed.

Sp. 3. *Acetate of Ammonia.* This salt, called formerly *spirit of Mindererus,* cannot easily be crystallized by evaporation, but it may be obtained in needles by slow sublimation. Its taste is similar to that of a mixture of sugar and nitre. It is very deliquescent. It melts at 170°, and sublimes at about 250°.

Sp. 4. *Acetate of Magnesia.* This salt does not crystallize. It has a sweetish taste. It is very soluble both in water and alcohol. It deliquesces in the air.

Sp. 5. *Acetate of Lime.* This salt crystallizes in needles, and has a glossy appearance like satin. Its taste is bitter and acid. It is soluble in water, and not altered by exposure to the air.

Sp. 6. *Acetate of Barytes.* This salt crystallizes in fine, transparent, prismatic needles. Its taste is acid and somewhat bitter. It dissolves in little more than its weight of water, and rather effloresces in the air. Alcohol dissolves about $\frac{1}{100}$ of its weight of it.

Sp. 7. *Acetate of Strontian.* This salt crystallizes. Its taste is not unpleasant. It dissolves in little more than its weight of cold water. It gives a green colour to vegetable blues.

Sp. 8. *Acetate of Alumina.* This salt crystallizes in needles, is very deliquescent, and has an astringent taste.

Sp. 9. *Acetate of Yttria.* This salt crystallizes in six-sided plates of an amethyst red colour, and is not altered by exposure to the air.

Sp. 10. *Acetate of Glucina.* This salt does not crystallize, but yields a gummy mass. Its taste is sweet and astringent.

Sp. 11. *Acetate of Zirconia.* This salt does not crystallize, but may be obtained in the state of a powder, which does not attract moisture from the air. Its taste is astringent. It is very soluble in water and in alcohol.

The following Table exhibits a view of the constituents of these salts, as far as they have been ascertained.

Acetates of	Acid.	Base.
Alumina	100	35.48
Magnesia	100	41.55
Ammonia	100	45.40
Lime	100	53.58
Soda	100	58.04
Strontian	100	89.80
Potash	100	108.45
Barytes	100	131.60

Genus II. *Benzoates.*

Benzoates.

This genus of salts has been so superficially examined, that a detailed description of the species cannot be given. All the benzoates examined are soluble in water, crystallize, and have a sharp saline taste. The benzoates of ammonia and alumina deliquesce, the others do not. Most of the species form feather-shaped crystals.

Genus III. *Succinates.*

Succinates.

This genus of salts is almost as little known as the preceding. Most of the succinates crystallize. Succinate of magnesia is an exception; and succinates of barytes and glucina are nearly insoluble in water.

Genus IV. *Moroxylates.*

Moroxylates.

Only two species of this genus have been examined, the moroxylates of lime and ammonia, both of which crystallize in needles, and are soluble in water.

Genus V. *Camphorates.*

Camphorates.

The salts belonging to this genus have usually a bitterish taste. When heated they are decomposed, and the acid commonly sublimes. Before the blowpipe they burn with a blue flame.

Sp. 1. *Camphorate of Potash.* This salt is white and transparent, and crystallizes in hexagons. It dissolves in 100 parts of cold, and in four parts of hot water. Alcohol also dissolves it, and burns with a deep blue flame. When heated it melts, and the acid is volatilized.

Sp. 2. *Camphorate of Soda.* This salt is white and transparent. Its crystals are irregular. It dissolves in rather more than 100 parts of cold, and in eight parts of hot water. It is soluble in alcohol. It effloresces slightly in the air.

Sp. 3. *Camphorate of Ammonia.* This salt does not readily crystallize. It is opake, and has a sharp bitterish taste. It dissolves in about 100 parts of cold, and three parts of hot water. It is soluble in alcohol. When heated it sublimes.

Sp. 4. *Camphorate of Magnesia.* This salt does not crystallize. It is white, opake, and has a bitter taste. It requires about 290 parts of water to dissolve it. Cold alcohol does not act on it, hot alcohol decomposes it, and dissolves the acid.

Sp. 5. *Camphorate of Lime.* This salt does not crystallize. Cold water dissolves very little of it; hot water dissolves about $\frac{1}{100}$th part. It is insoluble in alcohol. In the air it falls to powder. When heated it melts, and the acid is volatilized.

Sp. 6. *Camphorate of Barytes.* This salt does not crystallize. It has little taste. It is scarcely soluble in water or alcohol. It is not altered by exposure to the air. When heated it melts, and the acid is volatilized.

Sp. 7. *Camphorate of Alumina.* This salt is a white powder, with an acid, bitter, astringent taste. It dissolves in about 200 parts of cold water, and in a much smaller quantity of hot water. Hot alcohol dissolves it readily.

Genus VI. *Oxalates.*

Oxalates.

The salts belonging to this genus are easily decomposed in a red heat; water, carbonic acid, carbonic oxide, carbureted hydrogen and charcoal are evolved, and the acid destroyed. The alkaline oxalates are soluble in water, and crystallize. They combine with an excess of acid, and form super-oxalates. The earthy oxalates are insoluble in water, or nearly so. Lime water occasions a precipitate in the solution of oxalates, provided there be no great excess of acid.

Sp. 1. *Oxalate of Potash.* This salt crystallizes in flat rhomboids. Its taste is cooling and bitter. It dissolves in thrice its weight of cold water. It absorbs a little moisture from the atmosphere.

Sp. 2. *Superoxalate of Potash.* This salt is extracted from sorrel, and usually sold under the name of the *essential salt of lemons*. Its crystals are small opake parallelopipeds. It has an acid, pungent, bitterish taste. It dissolves in about ten times its weight of boiling water, but requires a much greater quantity of cold water. It is not altered by exposure to the air. It contains exactly double the quantity of acid which the oxalate of potash contains.

Sp. 3. *Quadroxalate of Potash.* This salt was lately discovered by Dr Wollaston, by digesting superoxalate of potash in nitric or muriatic acids. One half of the alkali is separated, and there remains behind a salt, which may be obtained in crystals, and which contains four times the proportion of acid that exists in oxalate of potash.

Sp. 4. *Oxalate of Soda.* This salt crystallizes, and has nearly the same taste with the oxalate of potash. When heated it falls to powder, being deprived of its water of crystallization.

Sp. 5. *Oxalate of Ammonia.* This salt crystallizes in four-sided prisms, terminated by dihedral summits. Its taste is bitter and unpleasant, somewhat similar to that of sal-ammoniac. 100 parts of cold water dissolve 4½ of this salt. It is insoluble in alcohol. When distilled, carbonate of ammonia is disengaged, a little acid sublimed, and some charcoal left behind.

Sp. 6. *Oxalate of Alumina.* This salt does not crystallize, and has a yellow colour. It has a sweet astringent taste, is soluble in water, and sparingly soluble in alcohol. It deliquesces in the air.

The remaining species are nearly insoluble in water.

Sp. 7. *Oxalate of Magnesia.* This is a tasteless white powder, not sensibly soluble in water; yet oxalate of ammonia does not occasion a precipitate when dropt into sulphate of magnesia.

Sp. 8. *Oxalate of Lime.* This is a white powder, insoluble in water, which makes its appearance when oxalate of ammonia is poured into any neutral salt with base of lime. It is tasteless, and dissolves readily in acids.

Sp. 9. *Oxalate of Barytes.* This is an insoluble, tasteless, white powder. With an excess of acid, it may be obtained crystallized in needles.

Sp. 10. *Oxalate of Strontian.* This is a white, insoluble, tasteless powder.

Sp. 11. *Oxalate of Yttria.* This is also a white, insoluble, tasteless powder.

The following Table exhibits the composition of the oxalates, as far as ascertained:—

Oxalates of	Acid.	Base.
Ammonia	100	38.2
Magnesia	100	37.6
Soda	100	69.7
Lime	100	61.2
Potash	100	102.7
Strontian	100	119.5
Barytes	100	164.3

GENUS VII. *Mellates.*

Mellates.

This genus of salts has been but imperfectly examined. The alkaline mellates are soluble in water, and crystallize. The earthy do not appear soluble, and therefore are usually in the state of flaky powders.

GENUS VIII. *Tartrates.*

Tartrates.

These salts, when exposed to a red heat, are decomposed, and the base remains in the state of a carbonate, usually mixed with charcoal. The earthy tartrates are nearly insoluble in water; the alkaline are soluble; but they combine with an excess of acid, and are converted into supertartrates, which are much less soluble than the tartrates. They readily combine with another base, and form triple salts.

Sp. 1. *Tartrate of Potash.* Of this salt there are two varieties. The first, containing an excess of acid, is usually called *tartar.* The second, which is neutral, is called *tartrate of potash*, and formerly it was called *soluble tartar*, from its greater solubility in water.

Variety 1. *Supertartrate of Potash*, or *Tartar.* This salt deposites itself on the sides of casks in which wine is kept. It is purified by solution and evaporations. It is from it that tartaric acid is usually obtained. Its crystals are small and irregular. Its taste is acid, and rather unpleasant. It is brittle, and soluble in about 60 parts of cold water. It is not altered by exposure to the air, but when kept dissolved in water is gradually decomposed. When distilled, it gives out a great deal of heavy inflammable air, and carbonic acid gas; and an acid liquor is obtained, formerly called *pyrotartarous acid*, but now known to be merely the acetic, contaminated with a little empyreumatic oil. The tartar of commerce contains about 5 per cent. of tartrate of lime.

Variety 2. *Tartrate of Potash.* This salt may be formed by saturating the preceding with potash or its carbonate. Its crystals are flat four-sided rectangular prisms, terminated by dihedral summits. It dissolves in about its own weight of cold water. Its taste is an unpleasant bitter.

Sp. 2. *Tartrate of Soda.* This salt crystallizes in needles. It is soluble in its own weight of cold water. It is capable of forming a *supertartrate.*

Sp. 3. *Tartrate of Ammonia.* This salt crystallizes in small polygonal prisms. It has a cooling bitter taste. It is very soluble in water. It is said also to be capable of forming a *supertartrate.*

Sp. 4. *Tartrate of Potash and Soda.* This salt may be formed by saturating *tartar* with carbonate of soda. It was formerly called *Rochelle salt*, and *salt of Seignette.* It crystallizes in large irregular prisms. It has a bitter taste, is very soluble in water, and effloresces when exposed to the air.

Tartar forms also a triple salt when neutralized by ammonia.

Sp. 5. *Tartrate of Magnesia.* This salt is insoluble in water, unless it contains an excess of acid. In that case it crystallizes in six-sided prisms.

Tartar forms a triple salt when neutralized by magnesia.

Sp. 6. *Tartrate of Lime.* This salt is a white powder, insoluble in cold water. It is difficult to free it from water by heat. An excess of acid renders it soluble.

Tartar forms a triple salt when neutralized by lime.

Sp. 7. *Tartrate of Barytes.* This salt is soluble; but its properties have not been ascertained.

Sp. 8. *Tartrate of Strontian.* This salt crystallizes in triangular tables. It is insipid, and nearly insoluble in water.

Tartar forms triple salts when neutralized by barytes and strontian.

Sp. 9. *Tartrate of Alumina.* This salt does not crystallize, but forms a gummy mass soluble in water. Its taste is astringent. It does not deliquesce.

Tartar forms a triple salt when neutralized by alumina.

Sp. 10. *Tartrate of Yttria.* This salt is soluble in water, but not to a great degree.

The following Table exhibits the composition of the tartrates as far as it has been ascertained.

Tartrates of	Acid.	Base.
Alumina	100	31.06
Magnesia	100	36.30
Ammonia	100	39.67
Lime	100	45.00
Soda	100	50.80
Strontian	100	78.60
Potash	100	72.41
Barytes	100	131.41

GENUS IX. *Citrates.*

Citrates.

When barytes is poured into a solution of a citrate, a precipitate appears. They are decomposed also by the mineral acids, and by oxalic and tartaric acids. When distilled, they yield traces of acetic acid. When kept dissolved in water, the acid is gradually decomposed.

Sp. 1. *Citrate of Potash.* This salt does not crystallize easily. It is very soluble in water, and readily deliquesces.

Sp. 2. *Citrate of Soda.* This salt crystallizes in six-sided prisms, not terminated by pyramids. Its taste is salt and cooling, but mild. It dissolves in less than twice its weight of water. When exposed to the air it effloresces slightly.

Sp. 3. *Citrate of Ammonia.* This salt crystallizes in elongated prisms. Its taste is cooling, and moderately saline. It is very soluble in water.

Sp. 4. *Citrate of Magnesia.* This salt is very soluble in water. It does not crystallize.

Sp. 5. *Citrate of Lime.* This is a white powder scarcely soluble in water, but with an excess of acid it may be obtained in crystals.

Sp. 6. *Citrate of Barytes.* This salt is very imperfectly insoluble in water. It may be obtained in the state of a white powder, or of silky flakes.

Sp. 7. *Citrate of Strontian.* This salt is soluble in water. It may be obtained in crystals; and is said to resemble in its properties the oxalate or tartrate of strontian.

GENUS X. *Kinates.*

Kinates.

Only one species of this genus of salts has been hitherto examined, namely *kinate of lime*, obtained by macerating yellow Peruvian bark in water, and evaporating the solution. It is white, crystallizes in rhomboidal plates, dissolves in about five times its weight of cold water, and is insoluble in alcohol. When heated sufficiently, it is decomposed, and the acid destroyed.

GENUS XI. *Saccolates.*

Saccolates.

These salts have hitherto been too superficially examined to admit of description. The alkaline saccolates are soluble in water, but the earthy are insoluble in that liquid.

GENUS XII. *Sebates.*

Sebates.

From the observations of Berzelius, it appears that the sebates approach very nearly to the benzoates in their properties.

GENUS XIII. *Urates.*

Urates.

For the best account of these salts, we are indebted to Dr Henry. They are white powders destitute of taste, and imperfectly soluble in water. Urate of ammonia is the most soluble, and urate of barytes the least soluble.

GENUS XIV. *Malates.*

Malates.

This genus of salts has also been imperfectly investigated. The alkaline malates are soluble in water, and deliquesce in the air. Malates of barytes and lime are nearly insoluble, but the latter combines with an excess of acid, and forms a supermalate of lime, which dissolves in water. This last salt is common in the vegetable kingdom. Malate of strontian dissolves in water, and malate of magnesia is very soluble in that liquid.

GENUS XV. *Formiates.*

Formiates.

These salts resemble the acetates in their properties, but they have been only superficially examined.

GENUS XVI. *Suberates.*

Suberates.

These salts have a bitter taste. They are all soluble in water, except the suberate of barytes. The earthy suberates scarcely crystallize. Most of these salts have an excess of acid.

GENUS XVII. *Gallates.*

Gallates.

The gallic acid seems scarcely capable of forming permanent salts with the salifiable bases. When the alkalies are dropt into a solution of gallic acid, it assumes a green colour. When the liquid is evaporated, the acid seems to be decomposed. Gallic acid occasions a blue or a red colour, when dropt into lime, barytes, or strontian water.

GENUS XVIII. *Prussiates.*

Prussiates.

The prussic acid combines with the salifiable bases, but the compounds have little permanency, as the acid is separated by mere exposure to the air, or by a heat of 120°. Hence these salts have been but little examined. It is capable of combining with an alkali or earth, and with a metallic oxide at the same time, and of forming triple salts, which have a great deal of permanency. The oxide of iron is the metallic oxide usually present. Of all these salts, the most important is the *prussiate of potash-and-iron*, or the *triple prussiate of potash*, as it is in common use as a re-agent. It crystallizes in cubes or parallelopipeds. It has a yellow colour, and is semi-transparent. It contains about one-fourth of its weight of oxide of iron. It has a bitter taste, and is insoluble in alcohol, though soluble enough in water.

SECT. II. *Of Metalline Salts.*

Of metalline salts.

Acids combine only with the oxides of metals: they seem incapable of uniting with metals themselves. Now most metals form more than one oxide, and acids are usually capable of combining with two oxides at least of the same metal. The properties of the salt vary a good deal according to the state of oxidizement of the oxide. Thus muriatic acid combined with the protoxide of mercury, forms a salt insoluble in water, and which acts merely as a cathartic when taken internally. The same acid, combined with the peroxide of mercury, forms a salt which is soluble in water, and constitutes one of the most virulent poisons known. To distinguish the state of oxidizement of the metal in these salts therefore is necessary. At present we shall satisfy ourselves with denoting those metalline salts that contain protoxides by the usual name; while to the names of those that contain a peroxide, the syllables *oxy* will be prefixed. Thus *sulphate of mercury* is the compound of sulphuric acid and protoxide of mercury; *oxysulphate of mercury* is the compound of the same acid, and peroxide of mercury. As there are twenty-seven metals, it is obvious that the genera of metalline salts are twenty-seven.

GENUS I. *Salts of Gold.*

Salts of gold.

The salts of gold are soluble in water, and the solution has a yellow colour. Triple prussiate of potash occasions a white precipitate in them, and the infusion of nutgalls gives them a green colour, and occasions a brown precipitate which is gold reduced. A plate of tin or muriate of tin occasions a purple precipitate. Sulphate of iron precipitates the gold in the metallic state.

Sp. 1. *Muriate of Gold.* This salt is easily obtained by dissolving gold in a mixture of one part nitric, and four parts muriatic acid. The solution takes place speedily, and with effervescence. It has a yellow colour, and when sufficiently concentrated, lets fall small yellow crystals of muriate of gold. They are four-sided prisms or truncated octahedrons, and exceedingly deliquescent. The taste of this salt is acerb, with a little bitterness. It tinges the skin of an indelible purple colour. It dissolves readily in alcohol, and seems more soluble in ether than in water. Almost all the metals throw down the gold from this salt, either in the metallic state or in that of a purple oxide. Hydrogen, phosphorus, and sulphurous acid, produce the same effect by depriving the gold of its oxygen. Muriate of tin occasions a beautiful powder, called *purple of cassius.* It is employed as a paint, and to give a red colour to glass and porcelain. According to Proust, it is a compound of three parts of the oxide of tin, and one part of gold, in the metallic state. But it seems more likely that the gold is in the state of protoxide.

Sp. 2. *Nitrate of Gold.* Nitric acid, containing a considerable proportion of nitrous gas in solution, dissolves gold, especially if it be much divided, as is the case in gold leaf. The solution has an orange colour, and cannot be evaporated to dryness without decomposition.

The other salts of gold have not hitherto been examined.

GENUS. II. *Salts of Platinum.*

Salts of platinum.

The solution of these salts in water has a brown or yellowish brown colour. No precipitate is produced by prussiate of potash or infusion of nutgalls. Sal-ammoniac occasions a copious yellow-coloured precipitate.

Sp. 1. *Nitrate of Platinum.* Nitric acid does not act upon platinum, but it dissolves its peroxide, and forms a salt not hitherto examined.

Sp. 2. *Muriate of Platinum.* This salt is obtained by dissolving platinum in aqua regia, and evaporating the solution, which is of a dark brown colour and opake. Small irregular crystals of muriate of platinum may be obtained, not more soluble in water than sulphate of lime. This salt has a disagreeable astringent metallic taste. Heat drives off the acid, and reduces the oxide to the metallic state.

The properties of the remaining species have been but imperfectly examined. Potash and ammonia are capable of combining with the salts of platinum, and forming compounds very little soluble in water. Hence a precipitate takes place when these alkalies are poured into solutions containing platinum.

GENUS III. *Salts of Silver.*

Salts of silver.

The nitric is the only acid which dissolves silver with facility, but they all combine with its oxides and form salts, most of which are but sparingly soluble in water. When the salts of silver are exposed to the action of the blow-pipe on charcoal, a globule of silver is obtained. Muriatic acid, or a muriate, occasions a white precipitate in their solutions, which becomes black when exposed to the light. The prussiates occasion a white precipitate, and the hydrosulphuret of potash a black precipitate in these solutions.

Sp. 1. *Nitrate of Silver.* There are two species of this salt; the first, which has been long known, is an *oxynitrate;* the second, recently discovered by Proust, is a *nitrate.*

1. *Oxynitrate.* Nitric acid dissolves silver with facility, nitrous gas being emitted. The solution is colourless and transparent; very heavy and very caustic. It tinges the skin of an indelible black, and is often used as a cautery. When evaporated sufficiently, it deposites crystals of oxynitrate of silver. They are usually in thin plates, transparent, and have an intensely bitter and metallic taste. It does not deliquesce, but becomes brown in a strong light. When heated, it readily melts, and congeals, when cold, into a grey mass, crystallized in needles. In this state it is cast into small cylinders, and used under the name of *lunar caustic* by surgeons, to open ulcers, and destroy fungous excrescences. It detonates when heated with combustibles, or when struck with phosphorus upon an anvil, and the silver is reduced. A moderate heat disengages the acid, and reduces the silver to the metallic state. It is composed of about seventy peroxide of silver, and thirty nitric acid.

2. *Nitrate.* This salt may be formed by boiling powder of silver in a saturated solution of oxynitrate of silver. A pale yellow coloured liquid is obtained, which contains nitrate in solution. This salt is exceedingly soluble in water, and is not easily crystallized. When sufficiently evaporated, it congeals entirely into a solid mass. When exposed to the air, or mixed with nitric acid, it speedily absorbs oxygen, and is converted into oxynitrate.

Sp. 2. *Hyperoxymuriate of Silver.* This salt may be obtained by boiling phosphate of silver in hyperoxymuriate of alumina. It is soluble in two parts of warm water; as the solution cools it crystallizes in small rhomboids, opake and dull like nitrate of lead. It is soluble in alcohol. When exposed to a moderate heat, oxygen gas is given out and muriate of silver remains. When mixed with sulphur, and struck upon an anvil, it detonates with prodigious violence.

Sp. 3. *Sulphate of Silver.* This salt may be formed by boiling powder of silver in sulphuric acid. A white mass is obtained, soluble in diluted sulphuric acid, and yielding crystals by evaporation. The crystals are small prisms. They dissolve in about 87 parts of water. They dissolve also in nitric acid. They melt when heated, and are easily decomposed, the silver being reduced. It is composed of about 17.4 acid and 82.6 peroxide of silver.

Sp. 4. *Sulphate of Silver.* This salt may be obtained by mixing sulphate of ammonia and nitrate of silver. It is a white powder, scarcely soluble in water, and having an acrid metallic taste. In the light it becomes brown. When heated it is decomposed, and the silver reduced.

Sp. 5. *Phosphate of Silver.* This is a white powder, insoluble in water, but soluble in nitric acid.

Sp. 6. *Carbonate of Silver.* This is a white insoluble powder, which becomes black when exposed to the light.

Sp. 7. *Fluate of Silver.* This is a white powder, insoluble in water.

Sp. 8. *Borate of Silver.* This likewise is a white insoluble powder.

Sp. 9. *Acetate of Silver.* This salt crystallizes in small prisms, easily soluble in water. When heated it swells, and yields a portion of ethereal liquor. The silver is reduced.

Sp. 10. *Benzoate of Silver.* This salt is soluble in water, and does not deliquesce.

Sp. 11. *Succinate of Silver.* This salt crystallizes in thin oblong radiated prisms.

Sp. 12. *Oxalate of Silver.* This is a white powder, scarcely soluble in water, insoluble in alcohol, but soluble in nitric acid.

Sp. 13. *Tartrate of Silver.* This salt is soluble in water.

Sp. 14. *Citrate of Silver.* This salt is insoluble in water. It is decomposed by nitric acid.

Sp. 15. *Saccolate of Silver.* A white insoluble powder.

Sp. 16. *Malate of Silver.* A white powder.

Sp. 17. *Arseniate of Silver.* An insoluble brown powder.

Sp. 18. *Chromate of Silver.* A beautiful crimson powder, which becomes purple when exposed to the light.

Sp. 19. *Molybdate of Silver.* A white flaky powder.

GENUS IV. *Salts of Mercury.*

Salts of mercury.

Mercurial salts when strongly heated are volatilized, and traces of mercury may sometimes be observed. The prussiates occasion in them a white precipitate; hydrosulphuret of potash, a black precipitate; and infusion of nutgalls, an orange yellow precipitate.

Sp. 1. *Nitrate of Mercury.* There are two species of this salt, first correctly distinguished by Bergman, namely the *nitrate* and *oxynitrate.*

1. *Nitrate.* This salt is obtained by dissolving mercury in diluted nitric acid without the assistance of heat. The solution is colourless, very heavy, and caustic. It tinges the skin indelibly black. It crystallizes in transparent octahedrons, having their angles truncated. Sulphureted hydrogen gas passed through the solution of this salt, reduces the mercury, which separates in combination with sulphur. Muriate of tin throws down the base in the state of running mercury.

2. *Oxynitrate.* This salt is formed when nitric acid is made to dissolve mercury with the assistance of heat; provided an excess of mercury be not present. By continuing the heat, the solution passes into a yellow coloured crystalline mass. When diluted with water, a white or yellow powder separates, which is a *suboxynitrate of mercury.*

Sp. 2. *Hyperoxymuriate of Mercury.* Mr Chenevix obtained this salt by passing a current of oxymuriatic acid through water, in which red oxide of mercury was diffused. By evaporating the solution, crystals of *oxymuriate* and *hyperoxymuriate of mercury* were deposited. The latter were picked out and purified by a subsequent crystallization. This salt is soluble in about four parts of water.

Sp. 3. *Sulphated Mercury.* Of this salt there are two species, the *sulphate* and *oxysulphate.*

1. *Sulphate.* This salt may be obtained by boiling over mercury, sulphuric acid diluted with its own bulk of water. Very little sulphurous acid gas is disengaged. By evaporation the salt is obtained in small prismatic crystals. It dissolves in 500 parts of cold water, and is not altered by exposure to the air. The alkalies throw down a dark-coloured sub-sulphate of mercury, when poured into a solution of this salt. The sulphate of mercury is composed of 12 acid, 83 protoxide, and 5 water.

2. *Oxysulphate.* When three parts of sulphuric acid are boiled on two parts of mercury, the whole, by continuing the heat, is converted into *oxysulphate.* This salt crystallizes in small prisms. When neutral, its colour is a dirty white; but when in the state of *super-oxysulphate,* it is of a fine white. The neutral salt is not altered in the air, the super-oxysulphate deliquesces. It is composed of 31.8 acid, 63.8 peroxide, 4.4 water. When water is poured upon this salt, it is decomposed and converted into *super-oxysulphate,* which dissolves, and *sub-oxysulphate,* which remains in the state of a beautiful yellow powder. This sub-salt is used as a pigment, and was formerly known by the name of *turpeth mineral.* It is composed of 15 acid and 85 peroxide.

Sp. 4. *Phosphate of Mercury.* This salt may be formed by mixing together the solutions of nitrate of mercury and phosphate of soda. It is a white powder, insoluble in water, lately introduced into medicine, and composed of 28.5 acid, 71.5 peroxide.

There seems to be no such salt as *phosphite of mercury.*

Sp. 5. *Carbonate of Mercury.* A white insoluble powder.

Sp. 6. *Fluate of Mercury.* A white insoluble powder.

Sp. 7. *Borate of Mercury.* A yellow insoluble powder.

Sp. 8. *Acetated Mercury.* Of this salt there are two species, the *acetate* and *oxacetate.*

1. *Acetate.* This salt may be obtained by mixing together solutions of nitrate of mercury and acetate of potash. Its crystals are plates of a silvery whiteness. It has an acrid taste, is insoluble in alcohol, and scarcely soluble in water.

2. *Oxacetate.* This salt may be formed by dissolving red oxide of mercury in acetic acid. It is a yellow mass, which does not crystallize, and soon deliquesces in the air.

Sp. 9. *Succinate of Mercury.* This salt crystallizes, and is soluble in water.

Sp. 10. *Benzoate of Mercury.* A white powder, insoluble in water, and very sparingly soluble in alcohol.

Sp. 11. *Oxalate of Mercury.* A white powder, scarcely soluble in water, which blackens when exposed to the light. It detonates when heated.

Sp. 12. *Mellate of Mercury.* A white powder.

Sp. 13. *Tartrate of Mercury.* An insoluble white powder, becoming yellow when exposed to the air.

Sp. 14. *Citrate of Mercury.* A white mass, scarcely soluble in water.

Sp. 15. *Prussiate of Mercury.* This salt may be formed by boiling red oxide of mercury and prussian blue in water. It crystallizes in four-sided prisms, terminated by four-sided pyramids. Its taste is acrid and metallic. It is white, and soluble in water.

Sp. 16. *Arseniate of Mercury.* A yellow insoluble powder.

Sp. 17. *Molybdate of Mercury.* A white flaky powder.

Sp. 18. *Chromate of Mercury.* An insoluble powder, of a fine purple colour.

GENUS V. *Salts of Palladium.*

Salts of palladium.

The salts of this metal are almost all soluble in water, and the solution has a fine red colour. Prussiate of potash occasions a dirty yellowish brown precipitate, hydrosulphuret of potash, and the alkalies, an orange-yellow precipitate when poured into solutions of these salts. Neither nitrate of potash nor sal ammoniac occasions any precipitate in them. Nitric, muriatic, and sulphuric acid, digested on palladium, acquire a red colour. But the true solvent of that metal is nitro-muriatic acid. The salts of palladium are not yet sufficiently known to admit of a particular description.

GENUS VI. *Salts of Rhodium.*

Salts of rhodium.

The solutions of these salts are red. Prussiate of potash, hydrosulphuret of potash, sal ammoniac, and alkaline carbonates, occasion no precipitate in them. But the pure alkalies throw down a yellow powder, soluble in an excess of alkali.

GENUS VII. *Salts of Iridium.*

Salts of iridium.

These salts are soluble in water. The solution is at first green, but becomes red when concentrated in an open vessel. Neither prussiate of potash nor infusion of nutgalls occasion any precipitate, but they render the solutions of iridium colourless.

GENUS VIII. *Salts of Osmium.*

Salts of osmium.

This genus of salts is still entirely unknown.

GENUS IX. *Salts of Copper.*

Salts of copper.

Most of these salts are soluble in water. The solution is blue or green, or at least it acquires these colours when exposed to the air. When ammonia is poured into these solutions, they assume a deep blue colour. Prussiate of potash occasions a greenish yellow precipitate, hydrosulphuret of potash a black precipitate, and gallic acid a brown precipitate in these solutions. A plate of iron or zinc put into these solutions precipitates the copper in the metallic state.

Sp. 1. *Nitrate of Copper.* Nitric acid attacks copper with some violence, nitrous gas is emitted, and the metal dissolved. By evaporation, the salt crystallizes in parallelopipeds. It has a blue colour, its taste is acrid and metallic, and it is exceedingly caustic. It is very soluble in water, and speedily deliquesces in the air. When heated, it undergoes the watery fusion; and, if the heat be increased, the acid is driven off, and the black oxide of copper remains in a state of purity. It detonates feebly on burning coals. It detonates when mixed with phosphorus and struck upon an anvil. When moistened and wrapt up in tin-foil, it sets the tin on fire. It is composed of 16 acid, 67 oxide, and 17 water.

Sp. 2. *Hyperoxymuriate of Copper.* This salt may be formed by passing a current of oxymuriatic acid through water, containing oxide of copper diffused through it.

Sp. 3. *Muriated Copper.* Of this salt there are two species, the *muriate* and *oxymuriate.*

Sp. 4. *Sulphate of Copper.* This salt has been long known, and in commerce is distinguished by the names of *blue vitriol* or *blue copperas.* It crystallizes in oblique parallelopipeds, has a blue colour, a styptic metallic taste, and is employed as a caustic. It is soluble in about four parts of cold water. When exposed to the air, it effloresces very slightly. By heat it is decomposed, and black oxide of copper remains. It reddens vegetable blue, and is, in fact, a supersulphate. The real sulphate crystallizes in four-sided prisms, terminated by pyramids. This salt is composed of 49.1 acid, and 50.9 oxide.

Sulphuric acid does not seem capable of combining with protoxide of copper.

Sp. 5. *Sulphite of Copper.* When sulphite of soda and sulphite of copper are mixed, whitish green crystals of sulphite of copper are deposited. They are sparingly soluble in water.

Sp. 6. *Phosphate of Copper.* A bluish green powder, insoluble in water.

Sp. 7. *Carbonate of Copper.* A beautiful apple green powder, insoluble in water. It is often found native, and is distinguished by mineralogists by the name of *malachite.*

Sp. 8. *Fluate of Copper.* This salt crystallizes in cubes of a blue colour.

Sp. 9. *Borate of Copper.* A green powder, scarcely soluble in water.

Sp. 10. *Acetate of Copper.* This salt was known to the ancients. It is sometimes called *verdigris*; though that name is more frequently applied to a *subacetate* of copper. It crystallizes in four-sided truncated pyramids. Its colour is a beautiful bluish green. Its taste is metallic and nauseous; and, like all the salts of copper, it is poisonous. It is sparingly soluble in cold water, but boiling water dissolves about one-third of its weight of it. It is soluble also in alcohol. When exposed to the air, it effloresces. When distilled, it yields acetic acid in considerable quantity. It is composed, according to Proust, of 61 acid and water, and 39 oxide of copper.

Sp. 11. *Succinate of Copper.* Small green crystals, not yet examined.

Sp. 12. *Benzoate of Copper.* Deep green crystals, sparingly soluble in water, and insoluble in alcohol.

Sp. 13. *Oxalate of Copper.* A green-coloured salt, scarcely soluble in water.

Sp. 14. *Tartrate of Copper.* Bluish green crystals, sparingly soluble in water.

Sp. 15. *Citrate of Copper.* Light green crystals.

Sp. 16. *Arseniate of Copper.* This salt is precipitated in the state of a bluish white powder, when arseniate of potash is poured into sulphate of copper. It is insoluble in water, unless it contains an excess of acid. It has been found native in Cornwall, in crystals, and has been analysed by Chenevix. There are five varieties of it, differing in the proportion of acid and oxide, in the figure of their crystals, and in colour.

The oxide of copper likewise combines with white oxide of arsenic, and forms a green powder, usually known by the name of *Scheele's green.*

GENUS X. *Salts of Iron.*

Salts of iron.

Most of the salts of iron are soluble in water; the solution has a green, or yellowish, or reddish colour, according to the state of oxidizement of the iron. Prussiate of potash throws down from these solutions a blue powder, or at least it becomes blue when exposed to the air. Hydrosulphuret of potash occasions a black precipitate. Gallic acid and the infusion of nut-galls throws down a black or purple precipitate.

Sp. 1. *Nitrate of Iron.* Diluted nitric acid acts with great energy upon iron, a gas being extricated, which is a mixture of nitrous gas and nitrous oxide. There are two varieties of this salt.

1. *Nitrate.* This salt may be formed by dissolving iron in nitric acid of the specific gravity 1.16. The action is slow, and little gas is extricated. The iron is in the state of black oxide. The solution cannot be heated or concentrated without converting the iron into red oxide.

2. *Oxynitrate.* This salt may be formed by concentrating the preceding. The liquid assumes a red colour, and the red oxide of iron at last precipitates. The salt may be obtained in crystals, by keeping nitric acid in contact with black oxide of iron. The oxide gradually dissolves, and four-sided prisms, nearly colourless, are gradually formed. They deliquesce in the air.

Sp. 2. *Hyperoxymuriate of Iron.* This salt may be formed by passing a current of oxymuriatic acid through water, having red oxide of iron mixed with it.

Sp. 3. *Muriated Iron.* Of this salt there are two species, the *muriate* and *oxymuriate.*

1. *Muriate.* This salt may be formed by dissolving iron filings in muriatic acid, without the contact of the external air. The solution is green, and yields green coloured crystals, very soluble in water. The solution absorbs nitrous gas in great abundance. When exposed to the air, it absorbs oxygen, and the salt is converted into oxymuriate.

2. *Oxymuriate.* This salt may be formed by exposing the preceding to the atmosphere, or by dissolving red oxide of iron in muriatic acid. The solution has a dark brown colour; the salt does not crystallize, but when evaporated to dryness, leaves a yellow-coloured mass, which deliquesces, and is soluble in alcohol. When heated, oxymuriatic acid is

given out, and black oxide of iron remains still combined with muriatic acid.

Sp. 4. *Sulphated Iron.* Of this salt, likewise, there are two species, the *sulphate* and *oxysulphate.*

1. *Sulphate.* This salt was known to the ancients, and is used in considerable quantity in dyeing, and in the manufacture of ink. It is easily obtained by dissolving iron in diluted sulphuric acid, and evaporating the solution. It has a green colour, sometimes very light, sometimes very dark. In this last state it is preferred by artists. Upon what the difference depends is not accurately known. It crystallizes in rhomboidal prisms. It has a very styptic taste, and always reddens vegetable blues. It is soluble in two parts of cold, and in less than its weight of boiling water. It is insoluble in alcohol. When alkali is poured into a solution of this salt, a white powder precipitates, which is a *subsulphate of iron.* When heated, it melts, and loses its water of crystallization. In a red heat, it loses most of its acid, and is converted into a red powder, known by the name of *colcothar of vitriol,* and used in polishing glass and metallic bodies. This salt is composed of 26.7 acid, 28.3 base, and 45 water.

2. *Oxysulphate.* This salt may be formed by exposing the solution of the preceding to the open air. It has a yellowish-red colour, does not crystallize, and when evaporated to dryness, soon attracts moisture, and becomes again liquid.

Sp. 5. *Sulphite of Iron.* Iron dissolves in sulphurous acid, without the emission of much gas. The solution yields crystals of sulphite, which are soon changed into sulphate by exposure to the air.

Sp. 6. *Phosphated Iron.* Of this salt there are two species, the *phosphate* and *oxyphosphate.*

1. *Phosphate.* This salt may be obtained by mixing solutions of phosphate of soda and sulphate of iron. It precipitates in the state of a blue powder. It is tasteless, insoluble in water, but soluble in nitric acid. It is found native, crystallized in blue-coloured prisms.

2. *Oxyphosphate.* This is a white powder, insoluble in water, but soluble in acids, and precipitated by ammonia. When violently heated, it melts into an ash-coloured globule. When treated with a fixed alkali, it loses a portion of its acid, and is converted into a brown-coloured powder. In this state it is a *suboxyphosphate of iron.* It is insoluble in water, and nearly so in acids. But it dissolves in the serum of blood, and is supposed by some to give the red colour to blood.

Sp. 7. *Carbonate of Iron.* This salt may be obtained by precipitating sulphate of iron by an alkaline carbonate. It has been found native, crystallized in rhombs, somewhat transparent, of a greenish-yellow colour, and brittle. It is composed of 36 acid, 59.5 protoxide, and two water. *Rust* is frequently a carbonate of iron. Hence it effervesces when dissolved in acids.

Sp. 8. *Fluate of Iron.* Fluoric acid dissolves iron readily. The solution does not crystallize, but assumes the form of a jelly.

Sp. 9. *Borate of Iron.* A yellow powder, insoluble in water.

Sp. 10. *Acetated Iron.* Of this salt there are two species, the *acetate* and *oxacetate.*

1. *Acetate.* It may be obtained by dissolving sulphuret of iron in acetic acid. It forms green-coloured prismatic crystals, sufficiently soluble in water.

2. *Oxacetate.* A reddish-brown liquid, which does not crystallize, but is easily converted into a jelly, which deliquesces. This liquid is much used by calico-printers.

Sp. 11. *Succinate of Iron.* A brownish red powder, insoluble in water, unless there be an excess of acid present.

Sp. 12. *Benzoate of Iron.* Yellow crystals, with a sweet taste, soluble in water and in alcohol.

Sp. 13. *Oxalated Iron.* Oxalic acid attacks iron rapidly, and combines with both its oxides.

1. *Oxalate.* Prismatic crystals of a green colour, very soluble in water, with an excess of acid.

2. *Oxygenized Oxalate.* A yellow powder, scarcely soluble in water, and incapable of crystallizing.

Sp. 14. *Tartrated Iron.* The *tartrate* crystallizes, and is sparingly soluble in water; the *oxytartrate* is red, does not crystallize, but runs into a jelly.

Sp. 15. *Citrate of Iron.* A brown coloured solution, which deposites small crystals, very soluble in water.

Sp. 16. *Malate of Iron.* A brown solution which does not crystallize.

Sp. 17. *Gallate of Iron.* A deep blue or black powder, insoluble in water.

Sp. 18. *Prussiated Iron.* The *prussiate* is a white powder, the *oxyprussiate* a deep blue powder; both insoluble in water.

Sp. 19. *Arseniated Iron.* The *arseniate* is a green-coloured salt, insoluble in water, found native, crystallizes in cubes. The *oxarseniate* is a brownish-red powder, likewise insoluble in water.

Sp. 20. *Tungstate of Iron.* An insoluble powder of a grey colour.

Sp. 21. *Molybdate of Iron.* An insoluble brown powder.

Sp. 22. *Columbate of Iron.* An insoluble mineral of a dark brownish-grey colour, and a lamellated structure.

GENUS XI. *Salts of Tin.*

Salts of tin.

Most of these salts are soluble in water, and the solution is colourless, or has a brownish colour, according to circumstances. The prussiates, when dropt into these solutions, occasion a white precipitate; hydrosulphuret of potash occasions a brownish black, or a golden yellow precipitate; corrosive sublimate occasions a black or a white precipitate; infusion of nut-galls occasions no precipitate in these solutions.

Sp. 1. *Nitrated Tin.* Nitric acid acts with great violence on tin, and speedily converts it into an oxide. When the acid is much diluted, it forms a yellow coloured solution, containing *deutoxide of tin.* But when the solution is left to itself, or when it is concentrated by evaporation, the oxide of tin is precipitated. When the acid is strong, it speedily converts the metal into peroxide without dissolving any of it. During the action ammonia is formed, and remains in combination with the acid.

Sp. 2. *Muriated Tin.* Muriatic acid dissolves tin when assisted by heat, and the salt formed is muriate of tin. By evaporation it is obtained in needle-shaped crystals soluble in water, and somewhat deliquescent. It has a strong affinity for oxygen, and readily imbibes it from the atmosphere, from oxy-muriatic and nitric acids, and from various metallic oxides and salts. Hence the remarkable changes which it produces on many metallic solutions.

Sp. 3. *Sulphate of Tin.* When tin is kept in sulphuric acid, little action takes place. However, the tin is gradually oxidized, and sulphurous acid gas is emitted. The sulphate of tin, formed, may be obtained in the state of fine needles by evaporation. It may be readily obtained by pouring sulphuric acid into muriate of tin; a white powder precipitates, which is the sulphate, and which dissolves in water and crystallizes.

The *Oxysulphate of tin* does not crystallize, but assumes the form of a jelly.

Sp. 4. *Sulphite of Tin.* When tin is kept in sulphurous acid, the acid is decomposed, oxide of tin dissolved, and sulphuret of tin precipitated.

Sp. 5. *Phosphate of Tin.* A white powder insoluble in water.

Sp. 6. *Carbonate of Tin.* As far as is known, this species of salt does not exist.

Sp. 7. *Fluate of Tin.* A gelatinous solution having a very disagreeable taste.

Sp. 8. *Borate of Tin.* A white powder insoluble in water.

Sp. 9. *Acetated Tin.* The *acetate* of tin crystallizes; the *oxacetate* forms a gummy incrystallizable mass.

Sp. 10. *Succinate of Tin.* This salt crystallizes, and is soluble in water.

Sp. 11. *Benzoate of Tin.* This salt is soluble in water, but insoluble in alcohol.

Sp. 12. *Oxalate of Tin.* Prismatic crystals, soluble in water.

Sp. 13. *Arseniate of Tin.* A white insoluble powder.

GENUS XII. *Salts of Lead.*

Salts of lead.

Many of these salts are scarcely soluble in water. Those that are, form colourless solutions, which have usually a sweet taste. The prussiates occasion a white precipitate in these solutions; hydrosulphuret of potash, a black precipitate; infusion of nutgalls, a white precipitate.

Sp. 1. *Nitrated Lead.* Of this salt there are two varieties; the first, composed of yellow oxide and nitric acid, has been long known; we shall call it *oxynitrate;* the second, or *nitrate,* has been lately discovered by Proust.

1. *Oxynitrate.* This salt is easily obtained by dissolving lead in diluted nitric acid, and evaporating the solution. The crystals are sometimes tetrahedrons, having their apexes truncated; sometimes octahedrons. They are opake and white, and have a silvery lustre. Their taste is sweet and harsh. They are not altered by exposure to the air. They dissolve in less than eight parts of boiling water. When heated, it decrepitates, and in a strong heat the acid is driven off, while at the same time the oxide is partially reduced to the metallic state. This salt is composed of 66 yellow oxide, 34 acid and water.

2. *Nitrate.* This salt is obtained by boiling lead in a solution of *oxynitrate.* A portion of the lead is dissolved, and the solution acquires a yellow colour. When evaporated, the salt crystallizes in scales, and in small prisms. The oxide in Dr Thomson's trials appeared to be the yellow; but Bucholz affirms that it contains less oxygen. This salt is composed of 81.5 oxide, 18.5 acid.

Sp. 2. *Hyperoxymuriate of Lead.* This salt is obtained by passing a current of oxymuriatic acid through water, in which oxide of lead is suspended. It is more soluble than muriate of lead, and is easily decomposed.

Sp. 3. *Sulphate of Lead.* This salt may be obtained by pouring sulphuric acid, or an alkaline sulphate, into nitrate of lead. It is a white powder, insoluble in water, in alcohol, and in nitric and acetic acids. It is found native, crystallized in octahedrons. It is composed of about 25 acid and 75 yellow oxide. A hundred parts of it, according to Kirwan, contain 71 of metallic lead. It may be heated to redness in a platinum crucible without alteration, but when in contact with charcoal, it melts, and the lead is reduced.

Sp. 4. *Sulphite of Lead.* This is a tasteless white powder, insoluble in water. It is composed of about 74.5 oxide, and 25.5 acid.

Sp. 5. *Phosphate of Lead.* A white tasteless powder insoluble in water, easily obtained by pouring phosphate of soda into nitrate of lead. It is found native, usually of a green or yellow colour, and is often crystallized in six-sided prisms. It is soluble in nitric and muriatic acids, and from the last solution muriate of lead precipitates. When heated, it melts, and assumes, on cooling, a regular polyhedral form. It is composed of 18 acid and 82 yellowish oxide.

Sp. 6. *Carbonate of Lead.* This is a white powder insoluble in water, easily obtained by mixing solutions of nitrate of lead, and an alkaline carbonate. It is found native, crystallized in six-sided prisms, and in tables. It is employed as a paint, under the name of *white lead.* It is composed of $16\frac{1}{3}$ acid, and $83\frac{2}{3}$ yellow oxide.

Sp. 7. *Fluate of Lead.* A white powder insoluble in water, unless there be an excess of acid.

Sp. 8. *Borate of Lead.* A white insoluble powder. Before the blowpipe it melts into a colourless glass.

Sp. 9. *Acetate of Lead.* Of this salt there are two varieties, the *superacetate* and *acetate.*

1. *Superacetate.* This salt has been long known. It is usually distinguished by the name of *sugar of lead.* It may be obtained by dissolving acetate of lead in acetic acid. It is much used by dyers and calico-printers. Its crystals are small needles, with a glossy appearance like satin. It has a sweet and rather astringent taste. Water dissolves rather more than $\frac{1}{4}$th of its weight of this salt. It is not altered by exposure to the air. When distilled, there comes over water acidulated with acetic acid, then a yellow inflammable liquor, which has some of the properties of ether. The gases extricated are carbonic acid in considerable quantity, with a very little heavy inflammable air. This salt is composed of 26 acid, 58 yellow oxide, 16 water.

2. *Acetate.* This salt may be obtained, by boiling together in water 100 parts of sugar of lead, and 150 parts of litharge. Its taste is less sweet; it is less soluble in water than the preceding variety; and it crystallizes in plates. A solution of this salt is employed by surgeons under the name of Goulard's extract.

Sp. 10. *Succinate of Lead.* Slender foliated crystals, scarcely soluble in water, but soluble in nitric acid.

Sp. 11. *Benzoate of Lead.* This salt forms white crystals soluble in water and alcohol, and decomposed by heat.

Sp. 12. *Oxalate of Lead.* Small crystals insoluble in alcohol, and scarcely soluble in water, unless there be an excess of acid present.

Sp. 13. *Tartrate of Lead.* An insoluble white powder decomposed by a moderate heat. It is composed of 37 acid, and 63 yellow oxide.

Sp. 14. *Citrate of Lead.* A white powder, difficultly soluble in water.

Sp. 15. *Malate of Lead.* A white powder, which precipitates in fine light flakes, and is insoluble in water, but easily soluble in acetic and weak nitric acid.

Sp. 16. *Arseniate of Lead.* A white powder, insoluble in water. It is composed of 35.7 acid, and 64.3 yellow oxide.

Sp. 17. *Molybdate of Lead.* A white powder, insoluble in water. It occurs native in rhomboidal plates, of a yellow colour, and is composed of 34.7 acid, and 65.3 yellow oxide.

Sp. 18. *Tungstate of Lead.* A white insoluble powder.

Sp. 19. *Chromate of Lead.* This is a fine red powder, with a shade of yellow, tasteless, and insoluble in water. It occurs native, crystallized in four-sided prisms, and is composed of 34.9 acid, and 65.1 oxide.

GENUS XIII. *Salts of Nickel.*

Salts of nickel.

The salts belonging to this genus have been but imperfectly examined. They are generally soluble in water, and the solution has a fine green colour. Prussiate of potash dropt into them occasions a dull green precipitate, hydrosulphuret of potash a black precipitate, and the infusion of nutgalls a greyish white precipitate.

Sp. 1. *Nitrate of Nickel.* This salt crystallizes in eight-sided prisms; has a fine green colour; when exposed to the air it first deliquesces, and afterwards falls to powder, and gradually loses the whole of its acid. It is composed of 55 acid, 25 oxide, and 20 water. It dissolves in alcohol.

Sp. 2. *Muriate of Nickel.* This salt may be obtained by dissolving nickel in nitromuriatic acid, and evaporating the solution. It crystallizes irregularly, has an apple green colour, and deliquesces in the air. When heated it loses its water, and may be sublimed in the state of golden yellow flowers, which become green by absorbing water from the atmosphere. This salt is composed of 34 oxide, 11 acid, and 55 water. It is soluble in alcohol.

Sp. 3. *Sulphate of Nickel.* This salt has a fine green colour, and crystallizes in four-sided prisms, terminated by four-sided pyramids. It is soluble in three times its weight of water, and effloresces in the air. It is composed of 25.63 oxide, 29.37 acid, and 65 water.

Sp. 4. *Carbonate of Nickel.* This salt is obtained by precipitating nitrate of nickel with carbonate of potash. It is a green powder, composed of 56.4 acid and water, 43.6 oxide.

Sp. 5. *Fluate of Nickel.* A salt which yields light green-coloured crystals.

Sp. 6. *Acetate of Nickel.* A salt which forms rhomboidal crystals of a green colour. It dissolves in six times its weight of water.

Sp. 7. *Oxalate of Nickel.* A green powder, scarcely soluble in water.

Sp. 8. *Arseniate of Nickel.* A soluble salt of an apple green colour.

Sp. 9. *Molybdate of Nickel.* A white insoluble matter.

Sp. 10. *Phosphate of Nickel.* A green insoluble matter.

Sp. 11. *Borate of Nickel.* Similar to the preceding.

GENUS XIV. *Salts of Zinc.*

Salts of zinc.

Most of the salts of zinc are soluble in acids, and may be formed directly by dissolving zinc in the different acids. Their solutions are transparent and colourless. Prussiate of potash occasions a white precipitate, and infusion of nutgalls no precipitate.

Sp. 1. *Nitrate of Zinc.* Nitric acid dissolves zinc with great rapidity. The solution yields flat four-sided prisms, which deliquesce in the air. They are very soluble both in water and alcohol. When heated they melt, and, in a strong heat, the acid is driven off, and the oxide remains.

Sp. 2. *Muriate of Zinc.* Muriatic acid dissolves zinc with rapidity. The solution does not crystallize, but yields a gelatinous mass, which deliquesces in the air. When heated it sublimes, and forms a white-coloured mass composed of small needles. It is very soluble in water.

Sp. 3. *Sulphate of Zinc.* Diluted sulphuric acid dissolves zinc with rapidity. The solution, when concentrated, yields crystals of sulphate of zinc. This salt was discovered at Ramelsberg in Germany, about the middle of the 16th century, and introduced into commerce under the name of *white vitriol*. Its crystals are four-sided flat prisms. Cold water dissolves nearly 1½ times its weight of it, and boiling water dissolves any quantity whatever. When heated it melts, and, at a red heat, it parts with most of its acid. It is composed of 28.2 oxide, 25.8 acid, and 46 water. It contains an excess of acid.

Sp. 4. *Sulphite of Zinc.* Sulphurous acid dissolves zinc, and, by evaporation, two distinct sets of crystals are obtained. The first of *sulphureted sulphite*, consisting of sulphite combined with sulphur. Its crystals are four-sided prisms, soluble both in water and alcohol. In the air they become white, and deposit an insoluble powder. They absorb oxygen very slowly when exposed to the atmosphere. The *sulphite of zinc* also crystallizes. It is less acrid, but more styptic in its taste than sulphureted sulphite. It is less soluble in water, and insoluble in alcohol. When exposed to the air, it is speedily converted into sulphate.

Sp. 5. *Phosphate of Zinc.* This salt does not crystallize, but yields, when evaporated, a mass like gum arabic.

Sp. 6. *Carbonate of Zinc.* This salt may be obtained, by precipitating sulphate of zinc by an alkaline carbonate. It occurs native, and is known by the name of calamine. It is composed of one part acid, and two parts oxide.

Sp. 7. *Fluate of Zinc.* This salt is soluble in water, and does not crystallize.

Sp. 8. *Borate of Zinc.* A white powder insoluble in water.

Sp. 9. *Acetate of Zinc.* Acetic acid readily dissolves zinc. The salt crystallizes in rhomboidal or hexagonal plates of a talky appearance. Its taste is bitter and metallic. It is soluble in water, and not altered by exposure to the air. On live coals it burns with a blue flame.

Sp. 10. *Succinate of Zinc.* Foliated crystals scarcely examined.

Sp. 11. *Benzoate of Zinc.* Needle-shaped crystals soluble in water and alcohol.

Sp. 12. *Oxalate of Zinc.* A white powder scarcely soluble in water.

Sp. 13. *Citrate of Zinc.* Small brilliant crystals insoluble in water.

Sp. 14. *Arseniate of Zinc.* A white powder insoluble in water.

The tungstate, molybdate, and chromate of zinc, are also insoluble in water. The first two are white, the last orange red.

GENUS XV. *Salts of Bismuth.*

Salts of bismuth.

This genus of salts has been but imperfectly examined. The solutions of them are usually colourless, and when water is added to them, a white powder precipitates unless there be a considerable excess of acid present. Prussiate of potash occasions a white precipitate, hydrosulphuret of potash a black precipitate, and infusion of nutgalls an orange precipitate, when poured into these solutions.

Sp. 1. *Nitrate of Bismuth.* Nitric acid attacks bismuth with great violence. The solution is colourless, and deposites small white crystals, which are four-sided prisms. They attract a little moisture in the air. They detonate feebly on burning coals, loudly when triturated with phosphorus. When dissolved in water they are decomposed, and a white powder, which is a subnitrate of bismuth, is deposited.

Sp. 2. *Muriate of Bismuth.* This salt may be obtained by dissolving bismuth in nitromuriatic acid, and evaporating to dryness. It forms small prismatic crystals. It sublimes when heated, and forms a white mass, which easily melts, formerly called *butter of bismuth.*

Sp. 3. *Sulphate of Bismuth.* This salt may be obtained by heating a mixture of bismuth and sulphuric acid. A white mass remains, decomposed by water.

Sp. 4. *Sulphite of Bismuth.* A white powder, insoluble in water.

Sp. 5. *Phosphate of Bismuth.* Crystals soluble in water, and not altered by exposure to the air. The *subphosphate of bismuth* is a white insoluble powder.

Sp. 6. *Acetate of Bismuth.* It may be obtained by mixing solutions of nitrate of bismuth and acetate of potash, and heating the mixture. Small talky crystals of acetate of bismuth gradually precipitate.

Sp. 7. *Succinate of Bismuth.* Yellow crystalline plates, soluble in water.

Sp. 8. *Benzoate of Bismuth.* Needle-shaped crystals, not altered by exposure to the air, soluble in water, and very sparingly soluble in alcohol.

Sp. 9. *Oxalate of Bismuth.* A white powder, scarcely soluble in water.

Sp. 10. *Tartrate of Bismuth.* A white insoluble powder.

Sp. 11. *Arseniate of Bismuth.* A white tasteless powder, sometimes having a shade of green; insoluble in water and nitric acid, but soluble in muriatic acid.

Sp. 12. *Molybdate of Bismuth.* A white insoluble powder.

GENUS XVI. *Salts of Antimony.*

Salts of antimony.

The oxides of antimony combine but imperfectly with acids, and the salts which they form have not been very carefully examined. Their solutions have usually a brownish yellow colour, and in most cases a precipitate falls when they are diluted with water. Prussiate of potash and infusion of nutgalls throw down a white precipitate, hydrosulphuret of potash an orange-coloured precipitate.

Sp. 1. *Nitrate of Antimony.* Nitric acid attacks antimony slowly. Nitrous gas is emitted, ammonia formed, and the metal converted into white oxide. A portion of it is dissolved, but it does not yield crystals.

Sp. 2. *Sulphate of Antimony.* Sulphuric acid oxidizes antimony at a boiling heat, and converts it into a white mass, from which water separates the acid.

Sp. 3. *Sulphite of Antimony.* This compound is precipitated in the state of a white powder, by pouring sulphurous acid into the solution of antimony in muriatic acid. It has an acrid and astringent taste, melts when heated, and is decomposed.

Sp. 4. *Phosphate of Antimony.* This salt is soluble in water: it does not crystallize.

Sp. 5. *Acetate of Antimony.* Acetic acid dissolves the oxides of antimony, and forms a salt which crystallizes, and is soluble in water.

Sp. 6. *Oxalate of Antimony.* Small crystalline grains, scarcely soluble in water.

Sp. 7. *Tartrate of Antimony.* This salt does not crystallize, but readily assumes the form of a jelly.

Sp. 8. *Arseniate of Antimony.* A white powder, insoluble in water.

Sp. 9. *Tartrate of Potash-and-Antimony.* This salt, usually called *tartar emetic*, was first made known to chemists in 1631. It may be prepared by mixing together equal parts of peroxide of antimony and tartar, and boiling them in ten times their weight of water, filtering the solution and evaporating it till a pellicle forms on the surface. It deposites regular crystals of tartar emetic. This salt is white, crystallizes in regular tetrahedrons, and gradually effloresces when exposed to the air. It dissolves in about $14\frac{1}{4}$ parts of cold water, and in about two parts of boiling water. Heat decomposes it by destroying the acid. It is composed of 35.4 tartaric acid, 39.6 peroxide of antimony, 16.7 potash, and 8.3 water.

GENUS XVII. *Salts of Tellurium.*

Salts of tellurium.

Tellurium is too scarce a metal to expect that its salts should be completely examined. The fixed alkalies throw down, from their solutions, a white powder, which is re-dissolved by an excess of alkali. Prussiate of potash occasions no precipitate, hydrosulphuret of potash throws down a brown or blackish precipitate, and infusion of nutgalls a flaky yellow precipitate.

Sp. 1. *Nitrate of Tellurium.* Nitric acid readily dissolves tellurium. The solution is colourless, and not rendered turbid by water. When concentrated, it yields small crystals in needles.

Sp. 2. *Muriate of Tellurium.* Nitro-muriatic acid dissolves tellurium. Water throws down a white precipitate from the solution, which is re-dissolved by adding more water.

Sp. 3. *Sulphate of Tellurium.* Sulphuric acid dissolves tellurium. Water precipitates a white powder from the solution.

GENUS XVIII. *Salts of Arsenic.*

Salts of arsenic.

Arsenic is readily converted into an acid, and even its white oxide has acid properties. Hence it does not form permanent salts with acids. The acids, however, dissolve it. Prussiate of potash occasions a white precipitate in these solutions, and hydrosulphuret of potash a yellow precipitate, while the infusion of nutgalls produces no change.

Sp. 1. *Nitrate of Arsenic.* Nitric acid dissolves arsenic with violence, and separates a white powder scarcely soluble in water.

Sp. 2. *Muriate of Arsenic.* Muriatic acid dissolves arsenic when assisted by heat. It dissolves also the white oxide, especially if a little nitric acid be added. The muriate of arsenic may be obtained in small crystalline grains.

Sp. 3. *Sulphate of Arsenic.* Sulphuric acid oxidizes arsenic by the assistance of heat; the sulphate is a white powder very imperfectly soluble in water.

Sp. 4. *Acetate of Arsenic.* Acetic acid dissolves the white oxide of arsenic, and deposites crystals scarcely soluble in water.

GENUS XIX. *Salts of Cobalt.*

Salts of cobalt.

Most of these salts are soluble in water, and the solutions have a red colour, unless a great excess of acid be present. Alkalies precipitate a blue powder; prussiate of potash throws down a brownish yellow precipitate; hydrosulphuret of potash, a black precipitate; infusion of nutgalls, a yellowish white precipitate.

Sp. 1. *Nitrate of Cobalt.* Nitric acid dissolves cobalt when assisted by heat, and yields red prismatic crystals, which deliquesce in the air.

Sp. 2. *Muriate of Cobalt.* Muriatic acid dissolves cobalt when assisted by the presence of a little nitric acid. The solution is green, or, if there be no excess of acid, blue, but it becomes red when diluted with water. This solution forms the oldest and best known *sympathetic ink.* It is very much diluted with water. Characters drawn with it on paper in that state are colourless when cold, but acquires a fine green colour when heated. When the muriate is heated, it sublimes in grey coloured flowers, which dissolves with great difficulty in water. The solution consists of common muriate of cobalt.

Sympathetic ink.

Sp. 3. *Sulphate of Cobalt.* Sulphuric acid dissolves the peroxide of cobalt with difficulty. The solution is red, and yields needle-form crystals, consisting of rhomboidal prisms, terminated by dihedral summits. It is soluble in 24 parts of cold water, insoluble in alcohol, and not altered by exposure to the air. It is composed of 26 acid, 30 oxide, 44 water.

This salt readily combines with potash and ammonia, and forms triple salts with each.

GENUS XX. *Salts of Manganese.*

Salts of manganese.

These salts are mostly soluble in water. Alkalies throw down from them a red or white precipitate, which becomes black when exposed to the air. Prussiate of potash occasions a yellowish white precipitate, hydrosulphuret of potash a white precipitate, gallic acid produces no change.

Sp. 1. *Nitrate of Manganese.* Nitric acid dissolves the black oxide of manganese with the assistance of heat, provided a little sugar be added. The solution is colourless, and does not yield crystals.

Sp. 2. *Muriate of Manganese.* Muriatic acid readily dissolves black oxide of manganese when assisted by heat, abundance of oxymuriatic acid separating. The solution is colourless, and deposits small crystals of *muriate of manganese.* These crystals are not easily formed. When obtained, they are hard, very soluble in water, and deliquesce in the air. Muriatic acid appears also to combine with red oxide of manganese, and to form a red solution containing oxymuriate of manganese.

Sp. 3. *Sulphated Manganese.* Sulphuric acid readily dissolves the white and red oxides of manganese. Upon the black it has no action, unless it be assisted by heat. In that case, oxygen gas is emitted in abundance, and the oxide is dissolved, being converted into red or white oxide, according to circumstances. There are two combinations of sulphuric acid and the oxides of manganese; one with the *white*, and another with the *red* oxide.

1. *Sulphate.* The solution of this salt is colourless, and yields, by evaporation, rhomboidal crystals. They have a very bitter taste, and are decomposed by heat, which drives off the acid.

2. *Oxysulphate.* The solution of this salt has a red colour. It does not readily crystallize, but when evaporated, easily passes into a jelly. When evaporated to dryness, it yields red coloured saline crusts,

very soluble in water, and not altered by exposure to the air.

Genus XXI. *Salts of Chromium.*

Salts of chromium.

The salts of chromium are but very little known. For the few facts ascertained, we are indebted to Richter, Godon, and Vauquelin. Prussiate of potash occasions a brown solution in these salts; infusion of nutgalls, a brown precipitate; hydrosulphuret of potash, a green precipitate, which a few drops of nitric acid change to yellow.

When the oxide of chromium is obtained by precipitating chromate of potash by means of a hydrosulphuret, it dissolves readily in acids. The solutions have a green colour, and the compounds are easily decomposed. Nitric acid seems to convert the oxide into chromic acid. It does not appear that these solutions are capable of affording crystals. The acids hitherto tried, and found capable of dissolving oxide of chromium, are the nitric, muriatic, sulphuric, phosphoric, sulphurous, and oxalic.

Genus XXII. *Salts of Molybdenum.*

Salts of molybdenum.

The salts belonging to this genus are as imperfect as those belonging to the preceding. None of them seem capable of crystallizing. But many acids dissolve oxide of molybdenum, and the solutions are remarkable for the changes of colour to which they are liable.

Nitric acid dissolves molybdenum with difficulty. If the quantity of metal be greater than the acid can dissolve, the solution is blue; but when a small quantity of molybdenum is dissolved in a considerable proportion of acid, the solution is yellowish brown.

Muriatic acid does not attack molybdenum, but it dissolves its oxide, and forms a blue coloured solution.

Sulphuric acid dissolves molybdenum when assisted by heat, and forms a yellowish brown or a blue solution, according to the proportion of metal acted on.

Genus XXIII. *Salts of Uranium.*

Salts of uranium.

Most of these salts are soluble in water, and the solution has a yellow colour. The pure alkalies occasion in these a yellow precipitate, prussiate of potash a brownish red precipitate, hydrosulphuret of potash a brownish yellow precipitate, and infusion of nutgalls a chocolate coloured precipitate.

Sp. 1. *Nitrate of Uranium.* Nitric acid readily dissolves uranium and its oxides. The solution, when sufficiently concentrated, yields crystals of nitrate, either in hexagonal tables, or in four-sided flat prisms, with a lemon yellow colour, and greenish edges. Water dissolves more than twice its weight of this salt, and alcohol more than thrice its weight of it. These liquids, when hot, dissolve any quantity of the salt whatever. Sulphuric ether dissolves about one-fourth its weight of this salt. Nitrate of uranium deliquesces in a moist atmosphere, but when kept at the temperature of 100° it soon falls to powder. When heated it melts, and, by continuing the heat, is decomposed. This salt is composed of 61 oxide, 25 acid, and 14 water.

By exposing the nitrate to a moderate heat, it is converted into a lemon-yellow powder, insoluble in water, which is a *sub-nitrate* of uranium.

Sp. 2. *Muriate of Uranium.* Deliquescent crystals of a yellowish green colour, having the form of four-sided tables.

Sp. 3. *Sulphate of Uranium.* Sulphuric acid scarcely acts upon uranium, but it gradually dissolves its oxide, and the solution yields small crystals of a lemon-yellow colour in prisms or tables. This salt dissolves in less than its weight of cold water, and in about half its weight of boiling water. Alcohol dissolves $\frac{1}{17}$th of its weight of it. Heat decomposes it, driving off the acid and water, but a violent temperature is necessary. This salt is composed of

Acid	18
Oxide	70
Water	12
	100

Sp. 4. *Acetate of Uranium.* Acetic acid dissolves oxide of uranium, and yields beautiful crystals in the form of long slender transparent four-sided prisms, terminated by four-sided pyramids.

Genus XXIV. *Salts of Tungsten.*

Salts of tungsten.

This genus of salts is still unknown. None of them, from the difficulty of obtaining the metal in a state of purity, having been hitherto examined.

Genus XXV. *Salts of Titanium.*

Salts of titanium.

The salts of titanium are, in general, soluble in water, and the solution is colourless. The alkaline carbonates occasion a flaky precipitate in these solutions, prussiate of potash a yellowish brown precipitate, hydrosulphuret of potash a dirty bottle-green, and the infusion of nutgalls a very bulky blood-red precipitate. When a rod of tin is plunged into a solution of titanium, the liquid around it gradually assumes a fine red colour. A rod of zinc occasions a deep blue colour.

Sp. 1. *Nitrate of Titanium.* Nitric acid dissolves the carbonate of titanium, and yields transparent crystals in the form of elongated rhombs, having two opposite angles truncated, so as to represent six-sided tables.

Sp. 2. *Muriate of Titanium.* Muriatic acid dissolves the carbonate of titanium, and forms transparent cubic crystals. From the experiments of Vauquelin and Hecht, it appears that it is the peroxide of titanium only that combines with muriatic acid.

Sp. 3. *Sulphate of Titanium.* Sulphuric acid dissolves the carbonate of titanium. The solution does not crystallize, but yields, when evaporated, a white opake gelatinous mass.

Genus XXVI. *Salts of Columbium.*

Salts of columbium.

This genus of salts has been but imperfectly examined. Hatchett, Ekeberg, and Wollaston, are the only persons who have hitherto made experiments on this scarce metal. Sulphuric, nitric, and muriatic acids scarcely dissolve the oxide of columbium. The oxalic, tartaric, and citric acids dissolve it readily. The solutions appear to be transparent and colourless. Neither prussiate of potash, nor hydrosulphuret of potash, occasion any precipitate in these solutions; but infusion of nutgalls throws down an orange coloured precipitate, provided there be no excess of acid present, but a slight excess of acid prevents the precipitate from appearing.

GENUS XXVII. *Salts of Cerium.*

Salts of Cerium.

The salts of cerium have either a white or a yellow colour, according to the state of oxidizement of the metal. Their solutions in water have a sweet taste. Hydrosulphuret of potash throws down a white precipitate, prussiate of potash a milk-white precipitate, and infusion of nutgalls no precipitate whatever. The oxalate of ammonia occasions a white precipitate, which is insoluble in nitric and muriatic acids.

Sp. 1. *Nitrate of Cerium.* Nitric acid dissolves white oxide of cerium readily: the solution is colourless, crystallizes with difficulty, retains an excess of acid, and has an austere and sweet taste. It dissolves the red oxide with difficulty unless heat be applied. The solution is yellow, and yields small white crystals, which deliquesce when exposed to the air. Both of these salts are soluble in alcohol. Heat decomposes them, leaving a red coloured oxide.

Sp. 2. *Muriate of Cerium.* Muriatic acid dissolves red oxide of cerium when assisted by heat, oxymuriatic gas is exhaled, and the solution has a yellowish red colour, which becomes lighter the longer the heat is continued. The solution yields four-sided prismatic crystals of a yellowish white colour. They are soluble in alcohol, and deliquesce when exposed to the air. Their taste is astringent and sweet. Heat decomposes this salt by driving off the acid and water.

Sp. 3. *Sulphate of Cerium.* Sulphuric acid dissolves the red oxide of cerium by long digestion, an orange-coloured solution is obtained, which yields small octahedral and needle-form crystals. The colour of these crystals is partly lemon yellow, partly orange. They are scarcely soluble in water. Their taste is acid and sweet. When exposed to the air, they soon fall into a yellow powder.

Sulphuric acid dissolves the white oxide of cerium very readily. The solution is colourless, has a sweet taste, and yields crystals of sulphate of cerium.

Sp. 4. *Carbonate of Cerium.* When white oxide of cerium is precipitated from its solutions by an alkaline carbonate, carbonate of cerium is obtained. It is a granular powder of a silvery whiteness, insoluble in water, and composed of 23 acid, 65 oxide, and 12 water.

Sp. 5. *Acetate of Cerium.* Acetic acid dissolves the white oxide of cerium, and forms small sweet-tasted crystals, soluble in water, but very sparingly soluble in alcohol.

CHAP. IV.

Of Hydrosulphurets.

Hydrosulphurets.

SULPHURETED hydrogen gas possesses many of the properties of an acid, and, like acids, it combines with the salifiable bases, and forms a class of bodies called *hydrosulphurets.* These bodies are of considerable importance, as they are frequently employed in chemical analysis, and enable us to separate the metallic oxides from alkalies and earths, because they throw down almost the whole of them from their solutions in an insoluble state.

Their properties.

The hydrosulphurets are soluble in water, and the solution is colourless. When the solution is exposed to the air, it becomes green or greenish yellow. After long exposure to the air, the solution becomes again limpid and colourless, and, on examination, is found only to contain the base of hydrosulphuret combined with sulphuric acid. The solution of the hydrosulphurets precipitates almost all the metallic oxides from their solutions; iron and lead, black; antimony, orange; arsenic, yellow, &c.

How formed.

The hydrosulphurets may be formed, by dissolving or diffusing the respective bases in water, and passing a current of sulphureted hydrogen gas through the liquid till it ceases to absorb any more. The excess of gas is then driven off by heat; and the hydrosulphuret may be obtained in a solid state if required by evaporation. The yellow colour which these solutions acquire when exposed to the air, is owing to the decomposition of the sulphureted hydrogen by the gradual absorption of oxygen from the atmosphere.

Hydrosulphurets of barytes,

Sp. 1. *Hydrosulphuret of Barytes.* When sulphate of barytes is converted into sulphuret by mixing it with charcoal, and heating it red hot in a crucible, if boiling water be poured upon the black mass, and filtered while hot, the green coloured solution thus obtained yields, by evaporation, a great number of crystals. These crystals are hydrosulphuret of barytes. They are white, and have a silky lustre. They have the form of scales, and the shape cannot easily be distinguished. This substance is soluble in water, the solution has a slight tint of green, its taste is acrid and sulphureous, and when exposed to the air is readily decomposed.

Strontian,

Sp. 2. *Hydrosulphuret of Strontian.* It may be procured by the same process as the preceding hydrosulphuret, and its properties are nearly similar.

Potash,

Sp. 3. *Hydrosulphuret of Potash.* This substance is formed during the solution of sulphuret of potash, and may be obtained by evaporation. It is transparent and colourless, and crystallizes in large prisms, not unlike the figure of sulphate of soda. Its taste is alkaline, and extremely bitter. When exposed to the air it soon deliquesces into a liquor of a syrupy consistence, tinging green all bodies with which it happens to come in contact. The crystals have no smell at first, but when they have deliquesced they emit a fetid odour. They dissolve both in water and alcohol, and during the evolution the temperature sinks considerably. Acids drive off the sulphureted hydrogen with a violent effervescence.

Soda,

Sp. 4. *Hydrosulphuret of Soda.* The crystals of this substance are transparent and colourless, having the figure of four-sided prisms terminated by quadrangular pyramids. Its taste is alkaline, and intensely bitter. It is very soluble both in water and alcohol, and during the solution cold is produced. When exposed to the air it deliquesces, and acquires a green colour. Acids drive off the sulphureted hydrogen.

Lime,

Sp. 5. *Hydrosulphuret of Lime.* This substance may be formed, by passing sulphureted hydrogen gas through water, having lime suspended in it. The solution is colourless, and has an acrid and bitter taste.

Ammonia,

Sp. 6. *Hydrosulphuret of Ammonia.* This compound may be formed by passing sulphureted hydrogen through liquid ammonia. When equal parts of lime, sal ammoniac, and sulphur, mixed with a little water, are distilled in a retort, a yellow liquid is obtained, usually distinguished by the name of *fuming liquor of Boyle,* because first prepared by that philosopher. This liquid is little else than hydrosulphuret of ammonia holding an excess of ammonia in solution.

Magnesia,

Sp. 7. *Hydrosulphuret of Magnesia.* This substance may be formed, by passing a current of sulphureted hydrogen through water in which magnesia is diffused. Its properties have not been hitherto examined.

Glucina, and Yttria.

Sp. 8 and 9. *Hydrosulphurets of Glucina* and of *Yttria.* From the experiments of Klaproth and Vauquelin, we know that the hydrosulphurets do not precipitate glucina or yttria from acids. Hence it is likely that they are capable of combining with sulphureted hydrogen, though these combinations have not hitherto been examined by chemists.

Neither alumina nor zirconia combine with sulphureted hydrogen. Hence the hydrosulphurets precipitate these earths from acids.

When the alkalies and alkaline earths are mixed with sulphur and water, and boiled in a glass vessel, a brown coloured solution is obtained, formerly called *liquid liver of sulphur.* At present the term *hydrogureted sulphurets* is applied to these solutions. They are conceived to be combinations of the alkaline bases with sulphur and sulphureted hydrogen at once, and therefore to be triple compounds. The proportion of sulphureted hydrogen is often very small.

The hydrosulphurets precipitate almost all the metals from their solutions. The precipitates vary in their colour according to the metal. The following Table exhibits a view of the colours of the various precipitates in these cases, as far as the subject has been investigated.

METALS.	PRECIPITATED BY	
	Hydrosulphuret of Potash.	Hydrogureted Sulphuret of Potash.
Gold . .	Black . .	Black
Platinum .	Black . .	Black
Silver . .	Black . .	Black
Mercury .	Brown black	Brown, becoming black
Palladium .	Black	
Copper . .	Black . .	Brown
Iron . . .	Black . .	Black, becoming yellow
Nickel . .	Black . .	Black
Tin . . .	Black . .	Black
Lead . . .	Black . .	White, becoming black
Zinc . . .	White . .	White
Bismuth . .	Black . .	Black
Antimony .	Orange . .	Orange yellow
Tellurium .	Black ? . .	Deep brown or black
Arsenic .	Yellow . .	Yellow
Cobalt . .	Black . .	Black
Manganese . .	White . .	White
Chromium . .	Green	
Molybdenum	Reddish brown	
Uranium .	Brown . .	Brownish yellow
Titanium .	Bottle-green	Bluish green.
Columbium	Chocolate	
Cerium . .	Brown	

CHAP. V.

Of Soaps.

Soaps.

THE fixed oils have the property of combining with alkalies, earths, and metallic oxides, and of forming a class of compounds which have received the name of SOAPS. As these soaps differ from each other very materially, according as their base is an alkali, an earth, or a metallic oxide, it will be proper to consider each set separately.

SECT. I. *Of Alkaline Soaps.*

Alkaline soaps.

All or most of the fixed oils are capable of combining with the alkalies, and forming soap; but the differences which they produce on the qualities of the soap have only been observed in a few cases. We can only consider the different species occasioned by different alkalies.

Sp. 1. *Soap of Soda,* or *Hard Soap.* The word *soap* (*sapo*, σαπὼν) first occurs in the writings of Pliny and Galen, and was obviously derived from the old German word *sepe:* for the knowledge of this useful compound seems first to have arisen among the Gauls and Germans.

Hard soap is made by mixing soda of commerce with a sufficient quantity of lime and water to deprive it of its carbonic acid, drawing off the ley, and boiling it with a quantity of olive oil or tallow, amounting to six times the weight of the soda used. When sufficiently boiled, a quantity of common salt is added, which induces the soap to separate from the water, and to float upon the surface. Though in this country, where kelp is usually employed at least in part to furnish the soda, the quantity of common salt present from the beginning is usually sufficient without any addition. The soap is then poured into proper vessels, and when cold cut into parallelopipeds. Whale oil has been tried, but found improper for making hard soap. In this country, tallow is usually employed. In France, and the south of Europe, olive oil is used. When oil or tallow alone is used, the soap has a white colour; but it is usual to add a quantity of rosin, which gives it a yellow colour, and a softer consistence. It is then called *yellow* soap.

The appearance and properties of common soap are so well known, that it is unnecessary to describe it. The various uses to which it is applied are equally well known. It dissolves in alcohol, but is precipitated by the addition of water. With water it readily mixes, though it does not, strictly speaking, dissolve in that liquid, as most of it is separated by the filter. A specimen of white soap analysed by Darcet, Lelievre, and Pelletier, was composed of

60.94	oil,
8.56	alkali,
30.50	water.
100.00	

Sp. 2. *Soap of Potash,* or *Soft Soap.* When potash is substituted for soda, the soap never hardens by cooling, but remains always soft. Whale oil is said to be employed in the manufacture of soft soap. A little tallow is also added, which, by peculiar management, is dispersed through the soap in fine white spots. The properties of soft soap are too well known to need description. It is the only species of soap with which the ancients were acquainted. It is but little used in this country in comparison of hard soap.

Sp. 3. *Soap of Ammonia.* This soap may be formed by digesting carbonate of ammonia on soap of lime. Its taste is more pungent than that of common soap. It mixes sparingly with water, but is pretty soluble in alcohol. The substance employed as an external application by surgeons under the name of *volatile liniment,* is scarcely any thing else than this soap.

SECT. II. *Of Earthy Soaps.*

Earthy soaps.

The earthy soaps differ essentially from the alkaline, in being insoluble in water, and therefore incapable of being used as detergents. They are formed whenever a solution of common soap in water is mixed with that of an earthy salt. Hence the reason that all waters holding an earthy salt in solution are unfit for washing. They decompose the common soap, and form a soap insoluble in water. Such waters are called *hard*, and are very frequent, especially in pit wells.

All the earthy soaps are insoluble in alcohol, except soap of magnesia, which dissolves both in alcohol and fixed oils. The earthy soaps are all white, and require a considerable heat to melt them.

SECT. III. *Of Metallic Soaps.*

Metallic soaps.

The metallic soaps may be formed in the same way as the earthy soaps. They are insoluble in water, and cannot be used as detergents; but several of them are soluble in alcohol and in fixed oils. The greater number of them have a white colour; but soap of cobalt is of a leaden colour; soap of iron, reddish-brown; and soap of copper, green. Berthollet, who examined these soaps, has recommended some of them as paints.

Some of the metallic oxides, as those of mercury, lead, and bismuth, when mixed with fat oils and water, and boiled, form an intimate combination with the oil, used by surgeons under the name of *plaster*. Litharge is the metallic substance commonly used for these compounds, and olive oil answers better than any other hitherto tried. These plasters soften when heated, and adhere very strongly to the skin when spread thin upon linen or leather, but they may be drawn off by using the requisite force, without leaving any portion adhering to the skin. In these properties their excellence consists.

BOOK III.

OF AFFINITY.

Of Affinity.

HAVING taken a view of the different substances which constitute the objects of chemistry, it remains for us to make a few remarks on the force by which different bodies are united together, and kept in combination. This force has received the name of *affinity*.

All the great bodies which constitute the solar system are urged towards each other by a force which preserves them in their orbits, and regulates their motions. This force has received the name of *attraction*. Newton demonstrated that this force is the same with *gravitation*, or the force by which a heavy body is urged towards the earth.

When two bodies are brought within a certain distance, they adhere together, and require a considerable force to separate them. Hence it appears that bodies are not only attracted towards the planetary bodies, but towards each other. In all cases we find the particles of matter united together in masses, differing indeed in magnitude, but containing all of them a considerable number of particles. These particles remain united, and cannot be separated without the application of a considerable force.

Thus we see that there is a certain unknown force which urges bodies towards each other; a force which acts not only upon large masses of matter, but upon the particles of which bodies are composed. Attraction, therefore, as far as we know, extends to all matter, and exists mutually between all matter.

The change which attraction produces on bodies is a diminution of their distance. Now the distances of bodies from each other are of two kinds, either too small to be perceived by our senses, or great enough to be easily perceived and estimated. Hence the attractions of bodies, as far as regards us, naturally divide themselves into two classes. 1. Those which act at sensible distances from each other. 2. Those which act at insensible distances. It is to the second of these attractions that the term *chemical affinity* has been given.

Chemical affinity then is the attraction which exists between the particles of bodies, which urges them towards each other, and keeps them united. Now the particles of matter are of two kinds, either *homogeneous* or *heterogeneous*. By homogeneous particles are meant the particles which compose the same body; by heterogeneous, those which compose different bodies. Thus the particles of iron are homogeneous; but a particle of iron and a particle of lead are heterogeneous.

Homogeneous affinity urges the homogeneous particles towards each other, and keeps them united. It is usually denoted by the term *cohesion*, and sometimes by *adhesion*, when the surfaces of bodies only are referred to.

Heterogeneous affinity urges heterogeneous particles towards each other, and keeps them at insensible distances, and of course is the cause of the formation of new integrant particles composed of a certain number of heterogeneous particles.

Affinity, like sensible attraction, varies with the distance of the attracting bodies; but the rate at which it varies remains still unknown. The characteristic marks of affinity may be reduced to the three following.

1. It acts only at insensible distances, and of course affects only the particles of bodies.

2. Its force is always the same in the same particles, but it is different in different particles.

3. This difference is not affected by the mass. Thus, if A have a greater affinity for C than B has, the mass of B may be considerably increased while that of A remains unchanged, yet B is not capable of taking a part of C from A.* Let us now take a particular view of gases, liquids, and solids, that we may ascertain in what way they unite, and how far their combinations are influenced by the state of the bodies themselves.

CHAP. I.

Of Gases.

Of Gases.

GASES are elastic fluids, which yield to the smallest impression, and have their parts easily moved. Their elasticity varies with the pressure, and hence it follows that their particles mutually repel inversely as the distances of their centres from each other. The gaseous bodies at present known (including some vapours) amount to 22. The following Table exhibits their names and their specific gravity.

Gases.	Specific Gravity.
Air	1.000
Chloric gas	2.713
Nitric acid	2.427
Sulphurous acid	2.097

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* This is the law for many years received by chemists as an axiom, and illustrated by Bergman at great length. It was lately called in question by Berthollet. But the experiments on which his opinion was founded have not stood the test of repetition.

Gases.	Specific Gravity.
Vapour of ether	2.250
Vapour of alcohol	2.100
Muriatic acid	1.278
Fluoric acid	——
Nitrous oxide	1.603
Carbonic acid	1.518
Sulphureted hydrogen	1.147
Oxygen	1.093
Nitrous gas	1.038
Azote	0.969
Carbonic oxide	0.956
Olefiant gas	0.974
Steam	0.700
Ammonia	0.600
Carbureted hydrogen	0.555
Arsenical hydrogen	0.529
Phosphureted hydrogen	0.852
Hydrogen	0.074

The gases usually contain water. This liquid, in most of them, is in the state of vapour, and intimately united. It may be partly separated by cold or by substances which have a strong affinity for water, as sulphuric acid, dry muriate of lime, and the dry fixed alkalies. From the experiments of Saussure we learn, that a hundred cubic inches of air saturated with moisture at the temperature of 57° contain 0.35 of a grain troy of moisture.

When gaseous bodies are brought into contact with each other, they mix equably, how much soever they differ in specific gravity; and when once mixed, they never after separate. By this mixture, neither the bulk nor the specific gravity of the gaseous bodies is altered. This mutual mixture seems to be analogous to what happens when liquids are mixed together, and seems explicable in the same way. It seems to be owing to a weak attraction which exists between the particles of all gaseous bodies. Mr Dalton affirms, that it is owing entirely to the difference between the size of the particles of different gases.

Several gases have the property of uniting intimately with each other, and of forming new products possessing peculiar properties. The following Table exhibits a view of those that unite upon simple mixture with the products which they form.

		Products.
Oxygen with	nitrous gas	Nitrous acid. Nitric acid.
Ammonia with	vapour	Liquid ammonia.
	muriatic acid	Muriate of ammonia.
	fluoric acid	Fluate of ammonia.
	carbonic acid	Carbonate of ammonia.
	sulphurous acid	Sulphite of ammonia.
	sulphureted hydrogen	Hydrosulphuret of ammonia.

The following are the gases which combine only in particular circumstances with the products which they form.

		Products.
Oxygen with	hydrogen	Water.
	carbonic oxide	Carbonic acid.
	azote	Nitric acid.
	sulphurous acid	Sulphuric acid.
	nitrous oxide	Nitric acid.

The combination of the first two sets is produced by combustion, and may be accomplished either by a red heat, or by the electric spark. Oxygen and azote unite slowly by means of electric sparks, but without combustion. Little is known of the way in which the remaining sets combine.

From the experiments hitherto made, it follows, that when gaseous bodies unite, they unite either in equal bulks of each, or two or three parts by bulk of one, unite with one part by bulk with the other. The following Table exhibits a view of the proportions of the different constituents by bulk, of various compounds formed by the union of elastic fluids.

Compounds.	*Constituents by bulk.*	
Muriate of ammonia	100 ammoniacal	100 muriatic acid gas
Carbonate of ammonia	100 ditto	100 carbonic acid gas
Subcarb. of ammonia	100 ditto	50 ditto
Water	100 hydrogen gas	50 oxygen gas
Nitrous oxide	100 azotic gas	50 ditto
Nitrous gas	100 ditto	100 ditto
Nitric acid	100 ditto	200 ditto
Nitric acid	200 nitrous gas	100 ditto
Nitrous acid	300 ditto	100 ditto
Ammonia	100 azotic gas	300 hydrogen
Sulphuric acid	100 sulphurous acid	50 oxygen
Oxymuriatic acid	300 muriatic acid	100 ditto
Carbonic acid	100 carbonic oxide	50 ditto

Some gases, when mixed together, have the property of mutually decomposing each other. The following is a list of these gases.

Oxygen with	phosphureted hydrogen
Sulphureted hydrogen with	nitrous gas sulphurous acid

Many gases decompose each other by combustion, produced either by electric sparks, or by a red-hot body. The following are the principal of these gases.

Oxygen with	sulphureted hydrogen carbureted hydrogen olefiant gas vapour of ether ——— alcohol
Nitrous oxide with	hydrogen phosphureted hydrogen sulphureted hydrogen carbonic oxide carbureted hydrogen olefiant gas vapour of ether ——— alcohol
Nitrous gas with	hydrogen sulphurous acid
Hydrogen with	sulphurous acid carbonic acid
Vapour of water with	carbureted hydrogen olefiant gas

Water absorbs a certain portion of all the gases. Some of them are absorbed only in small quantity by that liquid, others in large quantity. The following Table exhibits the bulk of each gas absorbed by 100 parts of water freed from air by boiling, as determined by the experiments of Dr Henry and Mr Dalton.

Gases.	Absorption according to Henry.	Dalton.
Carbonic acid	108	100
Sulphureted hydrogen	106	100
Nitrous oxide	86	100
Olefiant gas	——	12.5
Nitrous gas	5	3.7
Oxygen gas	3.7	3.7
Phosphureted hydrogen	2.14	
Carbureted hydrogen	1.4	3.7
Azotic gas	1.53	1.56
Hydrogen	1.61	1.56
Carbonic oxide	2.01	1.56

Dr Henry's numbers are the result of experiment: Mr Dalton's of experiment modified a little by a happy generalization. He conceives that the degree of the absorption of each of the four sets into which the gases are divided by the horizontal lines in the preceding table may be represented as follows:

First set, Water absorbs its own bulk $= \frac{1}{1^3}$

Second set, ———————— $\frac{1}{8}$th its bulk $= \frac{1}{2^3}$

Third set, ———————— $\frac{1}{27}$ ——— $= \frac{1}{3^3}$

Fourth set, ———————— $\frac{1}{64}$ ——— $= \frac{1}{4^3}$

From this generalization, which holds at least very nearly, it follows that the density of the gases, after absorption, is either the same as before it, or at least some submultiple of it, and the distance between their particles is either the same as before, or twice, thrice, or four times as great.

Dr Henry has shown, that whatever be the density of the gas, the bulk of it absorbed is always the same. If carbonic acid gas be reduced by pressure to twice the usual density, water still continues to absorb its own bulk of it. Hence by increasing the pressure, water may be made to absorb any *quantity* of a gas whatever.

The gases still retain their elasticity after they have been absorbed by water, accordingly they make their escape if the water be placed under the exhausted receiver of an air pump.

The proportion of a gas absorbed by water, depends very much upon its purity. This water absorbs its own bulk of pure carbonic acid gas; but if the carbonic acid gas be mixed with common air, the proportion of it absorbed is much diminished. Water impregnated with a gas must be in contact with a portion of the very gas absorbed, otherwise that gas soon makes its escape altogether.

As the temperature increases, the absorbability of the gases by water diminishes, no doubt in consequence of the increased elasticity of the gases.

This absorption of the gases by water is probably the consequence of an affinity between them and that liquid. Hence the determinate proportion of each absorbed, and most of the other phenomena, admit of an easy explanation.

The alkaline and acid gases are very absorbable by water, and of course are acted on by a strong affinity. The following Table exhibits a view of the bulk of each gas absorbed by one measure of water.

Sulphurous acid, . .	33
Fluoric acid, ...	175 +
Muriatic acid, ...	516
Ammoniacal gas. . .	780

When a cubic inch of water is saturated with these gases, its bulk increases. The following Table exhibits the bulk of water when thus saturated, supposing the original bulk to have been 1.

Saturated with

Sulphurous acid,	1.040
Muriatic acid, . .	1.500
Ammoniacal, . . .	1.666

Thus the water undergoes an expansion, so that the density of the gases absorbed is not in reality so great as it appears to be. The following Table exhibits the real densities of these gases in the water.

Sulphurous, ... 31.7 $= 3^3$ nearly.
Muriatic, ... 344.0 $= 7^3$
Ammonia, ... 468.0 $= 8^3$

That these gaseous bodies combine chemically with water, cannot be doubted.

The simple gases have the property of combining with different solid bodies, and of forming compounds sometimes gaseous, sometimes liquid, and sometimes solid. Oxygen combines with two dozes of carbon, forming carbonic acid, and carbonic oxide, both gases; the first a product of combustion, the second a combustible oxide. It combines with three doses of phosphorus, forming oxide of phosphorus, phosphorous acid, and phosphoric acid, all of which are solid bodies. It unites likewise with three doses of sulphur, and forms oxide of sulphur, sulphurous acid, and sulphuric acid; the first a solid, the second a gas, the third a liquid. It combines in various proportions with the metals, and all the metallic oxides are solids.

Hydrogen appears to combine in at least two proportions with each of the other simple combustibles. It unites also with several of the metals, but the proportions have not been ascertained.

Chap. II.

Of Liquids.

Of Liquids.

A liquid is a fluid, not sensibly elastic, the parts of which yield to the smallest impression, and move easily upon each other. All liquids have a certain cohesive force by which their particles are retained together, and this force is much greater in mercury than in water. The following Table exhibits a list of liquids, with their relative specific gravities.

Water	1.000
Ethers	0.632 to 0.900
Prussic acid	0.705
Petroleum	0.730 to 0.878
Volatile oils	0.792 to 1.094
Alcohol	0.796
Fixed oils	0.913 to 0.968
Supersulphureted hydrogen	——
Nitric acid	1.583
Sulphuric acid	1.885
Phosphuret of sulphur	——
Mercury	13.568

Most substances are rendered liquid by heat; but these are the only bodies that are permanently liquid in this country.

Some liquids may be mixed, and of course combine in any proportion whatever. In this respect they resemble the gases. The following is a list of these liquids:

Water with	alcohol. nitric acid. sulphuric acid.
Alcohol with . . .	ether.
Sulphuric acid with	nitric acid.
Fixed oils with . .	petroleum. volatile oils. fixed oils.
Volatile oils with .	petroleum. volatile oils.

These liquids, when once mixed, form a homogeneous compound, and do not afterwards separate again. The union is attended with the evolution of heat, and with a certain degree of condensation, for the specific gravity is always greater than the mean.

The following Table exhibits a list of those liquids that unite with each other only in certain proportions.

Water with	ether. volatile oils.
Alcohol with . . .	volatile oils. petroleum. phosphuret of sulphur.
Ether with	volatile oils. petroleum.
Volatile oils with .	petroleum.

The following Table exhibits a list of the most remarkable liquids that do not sensibly combine:

Water with	petroleum. fixed oils. supersulphureted hydrogen.
Fixed oils with . .	ether.
Mercury with . . .	water. alcohol. ether. volatile oils. petroleum.

No doubt the action of liquids on each other depends upon their affinity. The first class have the greatest affinity for each other; that of the second is greater, and that of the third is less than the cohesion of the particles of each.

Water has the property of combining with a very great number of solid bodies. It combines with them in two ways. In the first way, the solid retains its solidity, while the water loses its liquid form. Such combinations are called *hydrates*. In this way water combines with sulphur, metallic oxides, earths, alkalies, many acids, all salts, hydrosulphurets, and many animal and vegetable substances. In the second way, the water dissolves the solid, and the whole becomes liquid. In this way it acts upon many acids, alkalies, earths, salts, and vegetable substances.

These combinations are all chemical, and the hydrates appear to be the most intimate. Their specific gravity is always greater than the mean, while the specific gravity of saline solutions is usually less than the mean.

The action of the other liquids on solids has been hitherto but imperfectly investigated.

CHAP. III.

Of Solids.

Of Solids.

SOLIDS are bodies composed of particles that cohere together, and cannot be moved among themselves without the exertion of a force sufficient to destroy the cohesion of the body. They are very numerous, and their specific gravity varies more than that of gases or liquids. The following Table exhibits the specific gravity of the most remarkable solids:

	Sp. Gravity.
Charcoals	0.223 to 1.526
Vegetable bodies	0.240 to 1.354
Salts	0.273 to 7.176
Earths	0.346 to 4.842
Solid acids	0.667 to 3.391
Earthy compounds . . .	0.680 to 4.815
Bitumens and solid oils . .	0.892 to 1.357
Fixed alkalies	1.336 to 1.708
Phosphorus	1.770
Carburets of iron . . .	1.987 to 7.840
Sulphur	1.990
Glass	2.732 to 3.329
Carbon	3.518 to 3.531
Metallic sulphurets . . .	3.225 to 10.000
Metals and alloys and oxides	0.600 to 23.00

The following solids combine with each other in any proportion whatever:

Sulphur with phosphorus.
Carbon with iron?
Metals with most metals.
Protoxide of antimony with sulphuret of antimony.
Earths with earths.
Earths with some metallic oxides.
Some earths with fixed alkalies.
Fixed alkalies with solid oils.
Solid oils with each other and with bitumen.

All these combinations are produced by means of heat; unless they be brought into fusion, or at least one of them, they do not combine.

The following Table exhibits the principal solids, which have been observed to unite only in determinate proportions:

Sulphur with	metals. some metallic oxides. earths. fixed alkalies?
Phosphorus with . .	carbon. metals. some earths.
Acids with . . .	alkalies. earths. metallic oxides.

These combinations are more intimate than the preceding, they have been more accurately examined, and are better known. They never take place, unless one of the bodies at least be brought first into a liquid state, either by means of heat, or by solution in water.

The salts are the most important of these combinations, and a vast number of experiments have been made, in order to ascertain the proportions in which their constituents combine. The following Table exhibits the general result of these experiments. The numbers represent the weight of the different acids and bases which neutralize each other respectively.

Acids.		Bases.	
Sulphurous . .	54	Barytes . .	72.8
Oxalic . . .	39.5	Strontian . .	46
Nitric . . .	33.3	Potash . .	42.11
Sulphuric . . .	37.5	Soda . . .	29.75
Phosphoric . .	23	Lime . . .	27.2
Muriatic . . .	18	Magnesia . .	17.76
Carbonic . . .	20.5	Ammonia . .	9
Phosphorous . .	32		

Suppose we wish to form sulphate of barytes—from the above Table, it appears that we must unite together 37.5 parts by weight of sulphuric acid, and 72.8 parts of barytes.

From various experiments hitherto made, it appears that the supersalts contain twice as much acid, and the subsalts twice as much base, as the neutral salts. Suppose that a given quantity of sulphate of potash is composed of 100 potash, united with x of sulphuric acid, then supersulphate of potash is composed of 100 potash, united with $2x$ sulphuric acid. The triple salts appear to consist of two different salts united together. Thus alum may be considered as a compound of *sulphate of potash* and *sulphate of alumina*.

According to the old doctrine of affinity delivered by Bergman, all bodies capable of combining have an affinity for each other. This affinity is a constant force, which may be represented by numbers. Affinity is *elective*; that is to say, if a has a stronger affinity for m than b has, and if m be combined with b, forming a compound which we may represent by mb; a, upon being mixed with this compound, has the property of separating b completely from m, and taking its place, so as to form a compound ma, while b is entirely disengaged. This doctrine has been lately called in question by Berthollet. According to Berthollet, affinity is not elective, and never occasions decomposition, but only combination. The decompositions which take place are owing to other causes, such as insolubility, elasticity, &c. though this new opinion (if accurate) renders Bergman's tables of decomposition of little comparative value; yet, as it is, seems inconsistent with facts, and as his tables are in some cases useful, and are often referred to, it has been thought worth while to subjoin them here.

Table of Chemical Decompositions.

Table of chemical Decompositions.

I.
ALKALIES.

- Sulphuric acid
- Nitric
- Muriatic
- Phosphoric
- Fluoric
- Oxalic
- Tartaric
- Arsenic
- Succinic
- Citric
- Formic
- Benzoic
- Acetic
- Saclactic
- Boracic
- Sulphurous.
- Nitrous
- Carbonic
- Prussic.

II.
BARYTES AND STRONTIAN.

- Sulphuric
- Oxalic
- Succinic
- Fluoric
- Phosphoric
- Saclactic
- Nitric
- Muriatic
- Suberic
- Citric
- Tartaric
- Arsenic
- Benzoic
- Acetic
- Boracic
- Sulphurous
- Nitrous
- Carbonic
- Prussic

III.
LIME.

- Oxalic
- Sulphuric
- Tartaric
- Succinic
- Phosphoric
- Saclactic
- Nitric
- Muriatic
- Suberic
- Fluoric
- Arsenic
- Citric
- Malic
- Benzoic
- Acetic
- Boracic
- Sulphurous
- Nitrous
- Carbonic
- Prussic.

IV.
MAGNESIA.

- Oxalic
- Phosphoric
- Sulphuric
- Fluoric
- Arsenic
- Saclactic
- Succinic
- Nitric
- Muriatic
- Tartaric
- Citric
- Malic
- Benzoic
- Acetic
- Boracic
- Sulphurous
- Nitrous
- Carbonic
- Prussic

V.
ALUMINA.

- Sulphuric
- Nitric
- Muriatic
- Oxalic
- Arsenic
- Fluoric
- Tartaric
- Succinic
- Saclactic
- Citric
- Phosphoric
- Benzoic
- Acetic
- Boracic
- Sulphurous
- Nitrous
- Carbonic
- Prussic.

VI.
OXIDE OF GOLD.

- Muriatic acid
- Nitric
- Sulphuric
- Arsenic
- Fluoric
- Tartaric
- Phosphoric
- Prussic.

VII.
OXIDE OF SILVER.

- Muriatic acid
- Oxalic
- Sulphuric
- Saclactic
- Phosphoric
- Sulphurous
- Nitric
- Arsenic
- Fluoric
- Tartaric
- Citric
- Formic
- Acetic
- Succinic
- Prussic
- Carbonic.

VIII.
OXIDE OF MERCURY.

- Muriatic
- Oxalic
- Succinic
- Arsenic
- Phosphoric
- Sulphuric
- Saclactic
- Tartaric
- Citric
- Sulphurous
- Nitric
- Fluoric
- Acetic
- Boracic
- Prussic
- Carbonic

IX.
OXIDE OF COPPER.

- Oxalic acid
- Tartaric
- Muriatic
- Sulphuric
- Saclactic
- Nitric
- Arsenic
- Phosphoric
- Succinic
- Fluoric
- Citric
- Formic
- Acetic
- Boracic
- Prussic
- Carbonic.

X.
OXIDE OF IRON.

- Oxalic acid
- Tartarous
- Camphoric
- Sulphuric
- Saclactic
- Muriatic
- Nitric
- Phosphoric
- Arsenic
- Fluoric
- Succinic
- Citric
- Formic
- Acetic
- Boracic
- Prussic
- Carbonic.

XI.
OXIDE OF NICKEL.

- Oxalic acid
- Muriatic
- Sulphuric
- Tartaric
- Nitric
- Phosphoric
- Fluoric
- Saclactic
- Succinic
- Citric
- Formic
- Acetic
- Arsenic
- Boracic
- Prussic
- Carbonic.

XII.
OXIDE OF TIN.

- Tartaric acid
- Muriatic
- Sulphuric
- Oxalic
- Arsenic
- Phosphoric
- Nitric
- Succinic
- Fluoric
- Saclactic
- Citric
- Formic
- Acetic
- Boracic
- Prussic.

XIII.
OXIDE OF LEAD.

- Sulphuric acid.
- Saclactic
- Oxalic
- Arsenic
- Tartaric
- Muriatic
- Phosphoric
- Sulphurous
- Suberic
- Nitric
- Fluoric
- Citric
- Formic
- Acetic
- Boracic
- Prussic
- Carbonic.

XIV.
OXIDE OF ZINC.

- Oxalic acid
- Sulphuric
- Muriatic
- Saclactic
- Nitric
- Tartaric
- Phosphoric
- Citric
- Succinic
- Fluoric
- Arsenic
- Formic
- Acetic
- Boracic
- Prussic
- Carbonic.

XV.
OXIDE OF BISMUTH.

- Oxalic acid
- Arsenic
- Tartaric
- Phosphoric
- Sulphuric
- Muriatic
- Benzoic
- Nitric
- Fluoric
- Saclactic
- Succinic
- Citric
- Formic
- Acetic
- Prussic
- Carbonic.

XVI.
OXIDE OF ANTIMONY.

- Muriatic acid
- Benzoic
- Oxalic
- Sulphuric
- Nitric
- Tartaric
- Saclactic.
- Phosphoric
- Citric
- Succinic
- Fluoric
- Arsenic
- Formic
- Acetic
- Boracic
- Prussic
- Carbonic.

XVII.
OXIDE OF ARSENIC.

- Muriatic acid
- Oxalic
- Sulphuric
- Nitric
- Tartaric
- Phosphoric
- Fluoric
- Saclactic
- Succinic
- Citric
- Formic
- Arsenic
- Acetic
- Prussic.

XVIII.
OXIDE OF COBALT

- Oxalic acid
- Muriatic
- Sulphuric
- Tartaric
- Nitric
- Phosphoric
- Fluoric
- Saclactic
- Succinic
- Citric
- Formic
- Acetic
- Arsenic
- Boracic
- Prussic
- Carbonic.

XIX.
OXIDE OF MANGANESE.

- Oxalic acid
- Citric
- Phosphoric
- Tartaric
- Fluoric
- Muriatic
- Sulphuric
- Nitric
- Saclactic
- Succinic
- Tartaric
- Formic
- Acetic
- Prussic
- Carbonic

XX.
OXIDE OF TITANIUM.

- Phosphoric acid
- Arsenic
- Oxalic
- Sulphuric
- Muriatic
- Nitric
- Acetic

XXI.
SULPHURIC ACID.

- Barytes
- Strontian
- Potash
- Soda
- Lime
- Magnesia
- Ammonia
- Glucina
- Yttria
- Alumina
- Zirconia

XXII.
SULPHUROUS ACID.

- Barytes
- Lime
- Potash
- Soda
- Strontian
- Magnesia }
- Ammonia }
- Glucina
- Alumina
- Zirconia

XXIII.
PHOSPHORIC ACID.

- Barytes
- Strontian
- Lime
- Potash
- Soda
- Ammonia
- Magnesia
- Glucina
- Alumina
- Zirconia

XXIV.
PHOSPHOROUS ACID.

- Lime
- Barytes
- Strontian
- Potash
- Soda
- Ammonia
- Glucina
- Alumina
- Zirconia

XXV.
CARBONIC ACID.

- Barytes
- Strontian
- Lime
- Potash
- Soda
- Magnesia
- Ammonia
- Glucina
- Zirconia.

XXVI. Nitric Acid.	XXVII. XXVIII. Muriatic and Acetic Acids.	XXIX. Oxymuriatic Acid.	XXX. XXXI. XXXII. XXXIII. Fluoric, Boracic, Arsenic, and Tungstic Acids.	XXXIV. Oxalic Acid.	XXXV. Citric Acid.	XXXVI. Benzoic Acid.	XXXVII. Succinic Acid.	XXXVIII. Camphoric Acid.	XXXIX. Suberic Acid	XL. Prussic Acid.	XLI. Fixed Oils.
Barytes	Barytes	Potash	Lime	Lime	Lime	Potash	Barytes	Lime	Barytes	Barytes	Lime
Potash	Potash	Soda	Barytes	Barytes	Barytes	Soda	Lime	Potash	Potash	Strontian	Barytes
Soda	Soda	Barytes	Strontian	Strontian	Strontian	Ammonia	Potash	Soda	Soda	Potash	Fixed alkalies
Strontian	Strontian	Strontian	Magnesia	Magnesia	Magnesia	Barytes	Soda	Barytes	Lime	Soda	Magnesia
Lime	Lime	Lime	Potash	Potash	Potash	Lime	Ammonia	Ammonia	Ammonia	Lime	Ammonia
Magnesia	Ammonia	Ammonia	Soda	Soda	Soda	Magnesia	Magnesia	Alumina	Magnesia	Magnesia	Oxide of mercury
Ammonia	Magnesia	Magnesia	Ammonia	Ammonia	Ammonia	Alumina	Alumina	Magnesia	Alumina	Ammonia	Other metallic oxides.
Glucina	Glucina	Alumina	Glucina	Alumina	Alumina						Alumina.
Alumina	Alumina		Alumina		Zirconia.						
Zirconia.	Zirconia		Zirconia								

PART II.

CHEMICAL EXAMINATION OF NATURE.

Chemical Examination of Nature.

Having in the First Part of this article given a sufficient detail of the principles of Chemistry, and described the substances which are usually employed as instruments of investigation, it remains for us now to take a view of the different substances, as they exist in nature, constituting the material world, that we may ascertain how far the science of Chemistry will serve towards explaining their nature, and accounting for the various changes which they produce on each other. Now the different substances of which the material world, as far as we have access to it, is composed, may be arranged under the five following heads:

1. The Atmosphere.
2. Waters.
3. Minerals.
4. Vegetables.
5. Animals.

We shall take a view of each of these in succession.

BOOK I.

OF THE ATMOSPHERE.

Of the atmosphere.

The atmosphere is that invisible fluid which surrounds the earth to an indeterminate height, and which got its name from the Greeks, in consequence of the vapours that are continually floating in it. Two things respecting it claim our attention; 1. Its composition. 2. The changes which take place in it.

Chap. I.

Of the Composition of the Atmosphere.

Composition of the atmosphere.

For all the knowledge of the atmosphere which we possess, we are indebted to the moderns. The ancients made no progress in the investigation. Its weight was determined by Galileo, and his disciple Torricelli; its density, elasticity, and most of its mechanical properties, by Boyle; its relation to light and sound, by Hooke, Newton, and Derham: but for our knowledge of its composition, we are indebted to the labours of the chemists of the last century. Hales began the subject. Dr Black made an additional step. Dr Priestley discovered the substances of which it is composed. But Scheele and Lavoisier were the philosophers who first placed the subject in its true light; and the matter was in some measure completed by Mr Cavendish. The atmosphere consists always of the three following distinct parts. 1. Air. 2. Water. 3. Carbonic acid.

Sect. I. *Of Air.*

Air.

The word air is often used to denote the atmosphere in general; but in strict language it is applied to an elastic fluid, which constitutes by far the greatest portion of the atmosphere, and which is distinguished from the moisture and carbonic acid with which it is always mixed.

Its properties.

Air is an invisible elastic fluid. Its specific gravity is always reckoned 1.000; and its weight is such, that, at the temperature of 60°, and when the barometer stands at 30 inches, 100 cubic inches of dry air weigh 30.5 grains troy.

Its density always increases with the pressure, so that its bulk is always inversely as the pressure. Air itself, though it has the property of refracting light, is invisible. The blue colour of the sky is owing to the vapours with which the air is always mixed; and it depends upon the quantity of these vapours.

Air was determined by Scheele to be a mixture of oxygen gas and azotic gas; and this conclusion was confirmed by the experiments of Lavoisier, and of all subsequent chemists. Scheele determined the proportion of these two gases to be 27 by bulk of oxygen gas, and 73 of azotic gas. In these proportions M. Lavoisier acquiesced. Their method was to absorb the oxygen from a given bulk of atmospheric air, and to determine its quantity by the diminution of bulk. Mr Cavendish first demonstrated, that the proportion determined by Scheele and Lavoisier was inaccurate. He found air a mixture of 21 parts by bulk of oxygen gas, and 79 of azotic, very nearly. These proportions were confirmed by Berthollet, Davy, De Marti, and many other chemists, and are now universally acceded to.

Eudiometer.

The method of analysing atmospheric air is to abstract its oxygen, by means of some substance which has a strong affinity for it. The apparatus is usually called a *eudiometer*; because it was supposed at first that the proportion of oxygen in air is variable, and that the goodness of air depends upon the greatness of this proportion. And the name has been retained after this opinion has been given up.

First used by Dr Priestley.

The first eudiometer used was by Dr Priestley. It consisted in mixing 100 measures of air and 100 of nitrous gas in a tube. The goodness of the air was judged of by the greatness of the diminution. This method was improved by Fontana, and is usually distinguished by the name of the eudiometer of Fontana. Many attempts have been made to render it accurate; but it is in reality not much to be trusted, because the diminution of bulk varies with a variety of circumstances, which cannot easily be appreciated. It is greatest when a wide vessel is used, and least when the mixture is made in a narrow tube. According to Dalton, 21 measures of oxygen unite either with 36 measures of nitrous gas, or with $36 \times 2 = 72$ measures. The first proportion takes place in a narrow tube; the second in a wide vessel; in intermediate vessels the proportions are intermediate. Hence he uses a narrow tube. He lets up 100 measures of air, and then adds 50, or any greater number of measures of nitrous gas. The mixture takes place slowly, and the bulk gradually diminishes. In a few minutes, the diminution of bulk will have reached its maximum. Note it down, and multiply it by $\frac{7}{19} = 0.3684$. The product is the quantity of oxygen which the air examined contained. Suppose 100 measures of air to be examined, and the diminution of bulk to be 57;

Mr Dalton's eudiometer.

$$57 \times 0.3684 = 20.9988, \text{ or very nearly } 21.$$

This would indicate the oxygen in the air examined to be 21 measures. This method affords a tolerable approximation; but the error is generally greater than 1 per cent.

Mr Davy's eudiometer.

To avoid the ambiguity occasioned by the unequal diminution of bulk which takes place when air and nitrous gas are mixed, Mr Davy takes a strong solution of green sulphate of iron, makes it absorb a quantity of nitrous gas, and then agitates this liquid in the air to be examined. The whole oxygen is absorbed, and the diminution of bulk determines exactly how much oxygen the air contained. This method may be used, and is susceptible of great accuracy. The only objection to it, is the slowness with which the absorption of the oxygen takes place.

The liquid, made by boiling a mixture of lime and sulphur in a phial of water, which is yellow, may also be used with considerable precision. It was employed by Scheele, and in an improved form by De Morti. A stick of phosphorus in summer, may likewise be used with advantage. The residual gas ought to be agitated in water, to deprive it of a little phosphorus, which it usually holds in solution, and which may increase its bulk a little.

Volta's eudiometer.

But the best method of analysing air is the following, which was first put in practice by Volta, and is therefore called Volta's eudiometer. Mix equal bulks of air and hydrogen gas together, and pass an electric spark through the mixture. Combustion takes place. Note the diminution of bulk; one-third of that diminution is equal to the bulk of oxygen which the air examined contained.

Composition of air.

The result of all the trials hitherto made, gives us air a mixture of 21 measures of oxygen, and 79 of azote; or by weight, of

22.91 oxygen,
77.09 azote.
100.00

Sect. II. *Of Water.*

Water.

That water is always present in the atmosphere, is obvious from the clouds which constantly form in it, and from the rain and dew which are so frequently falling from it. Various instruments have been contrived to point out the quantity of water which the atmosphere contains. These instruments are called *hygrometers*. None of them are unexceptionable; but, upon the whole, the one contrived by Professor Leslie seems to be the best. From these instruments we learn, that the quantity of water in the atmosphere is exceedingly various. Sometimes very little can be detected, and sometimes the air is quite saturated with it.

Hygrometer.

From the experiments of Saussure, we learn, that a cubic foot of air, at the temperature of 66°, is capable of holding only about 8 grains troy, or $\frac{1}{81}$th its weight of water. The quantity increases with the temperature, and, according to Leslie, doubles for every additional 27° of temperature. Hence it is obvious, that the quantity of water in air depends, in some degree, on the temperature. At low temperatures, very little water can be present; but at high temperatures, air can contain a considerable quantity.

With respect to the state in which the water is contained in the air, there are two opinions which have divided philosophers. The first opinion is, that the water is dissolved by the air, and held in solution by it precisely as sugar or salt is by water. This opinion was started by Dr Hooke, explained at considerable length by Dr Halley, and fully discussed and supported by Leroy and Hamilton. The second opinion is, that the water is first converted into vapour, and that in that state it mixes with air precisely as one elastic fluid with another. This opinion, though with different modifications, was supported both by Saussure and Deluc, and has lately been maintained by Dalton, with arguments that appear decisive. When water evaporates or enters into air, it always produces cold, indicating a conversion into vapour. The same quantity of water evaporates, and continues in the state of vapour under an exhausted receiver, and in a receiver full of air. Vapour increases the bulk of air exactly in proportion to its quantity.

From the experiments of Dalton we learn, that in the torrid zone the quantity of vapour in the atmosphere varies from being able to support a column of mercury 0.6 inch in height, to being able to support a column 1 inch high. In Britain it seldom amounts to 0.6, but in summer is frequently at 0.5 inch. In winter it is often as low as 0.1 inch.

From this it appears, that the quantity of vapour in the atmosphere varies from $\frac{1}{50}$th to $\frac{1}{300}$th part of the atmosphere by weight. Mr Dalton supposes the medium quantity at once in the atmosphere to amount to about $\frac{1}{70}$th of its bulk.

Sect. III. *Of Carbonic Acid.*

Carbonic acid.

The existence of carbonic acid in the atmosphere became manifest, as soon as it had been determined by Dr Black, that alkalies owe their mild state to the presence of that gas. For it was known that a caustic alkali becomes gradually mild, when left exposed to the atmosphere. It has been found in air, upon the tops of mountains as well as in plains. Even air, brought by means of a balloon from the height of 4280 feet above the surface of the earth, was found to contain it. Hence we may conclude that it is universally diffused. The quantity of it is very small, and therefore determined with difficulty. At first it was conceived to amount to $\frac{1}{100}$th of the atmosphere, but it is certainly much less. Humboldt found it to vary from 0.005 to 0.01; but his method does not seem susceptible of precision. Dalton made it $\frac{1}{1400}$th of the air. Perhaps we shall not err far if we reckon it at a medium at $\frac{1}{1000}$th of the air. If we consider the numerous sources of this gas from the combustion of wood and coal and the breathing of animals, it must appear surprising that its bulk does not sensibly increase. This can only be accounted for by supposing, that nature has provided some means to decompose it as fast as it is formed.

For an account of the changes which take place in the atmosphere, see METEOROLOGY.

BOOK II. *Of Waters.* See the article WATERS.

BOOK III. *Of Minerals.* See the articles GEOGNOSY, MINERALOGY, ORYCTOGNOSY.

BOOK IV.

OF VEGETABLES.

Vegetables.

VEGETABLES are exceedingly numerous, nearly 40,000 species having been already described and arranged by botanists. It is the business of the chemist to analyse vegetables, to investigate the substances of which they are composed, the processes by which they are formed, and the changes to which they are subject after they have ceased to vegetate. We shall divide this Book into three Chapters. In the first, we shall give an account of the ingredients of plants; in the second, of the chemical phenomena of vegetation; and in the third, of the fermentations to which certain vegetable substances are liable, after they have ceased to vegetate.

CHAP. I.

Of the Ingredients of Plants.

Ingredients of plants.

THE substances hitherto found in the vegetable kingdom, all of them at least which have been examined with any degree of accuracy, may be reduced under four heads: I. Substances soluble in water, at least in some state or other, and which, in general, are solid and not remarkably combustible. II. Substances, either fluid, or which melt when heated, and burn like oil. They are all insoluble in water; but, in general, they dissolve in alcohol. III. Substances neither soluble in water, nor alcohol, nor ether, and which have a fibrous or woody texture. IV. Substances which belong to the mineral kingdom, which occur only in small quantity in vegetables, and may therefore be considered as extraneous or foreign. The following Table exhibits a view of the different vegetable substances hitherto discovered, arranged under their respective heads.

Table of vegetable substances.

I. 1. Acids.
2. Sugar.
3. Sarcocoll.
4. Asparagin.
5. Gum.
6. Mucus.
7. Jelly.
8. Ulmin.
9. Inulin.
10. Starch.
11. Indigo.
12. Gluten.
13. Albumen.
14. Fibrin.
15. Bitter principle.
16. Extractive.
17. Tannin.
18. Narcotic principle.

II. *Oleoform.*

1. Fixed oil.
2. Wax.
3. Volatile oil.
4. Camphor.
5. Bird-lime.
6. Resins.
7. Guaiacum.
8. Balsams.
9. Gum resins.
10. Caoutchouc.

III. *Fibrous.*

1. Cotton. 2. Suber. 3. Wood.

IV. *Extraneous.*

1. Alkalies. 2. Earths. 3. Metals.

The properties of these different substances form the subject of the following Sections.

SECT. I. *Of Acids.*

Acids found ready formed in vegetables.

The acids found ready formed in the vegetable kingdom are the following:—

1. Acetic.
2. Oxalic.
3. Tartaric.
4. Citric.
5. Malic.
6. Gallic.
7. Benzoic.
8. Prussic.
9. Phosphoric.

The sulphuric, nitric, and muriatic acids, are likewise to be found in vegetables combined with alkalies, but only in small quantities.

1. Acetic acid has been detected in the sap of different trees, in the acid juice of the *cicer parietinum,* and in the *sambucus nigra.*

2. Oxalic acid in the state of *superoxalate of potash,* exists in the leaves of the *oxalis acetosella, oxalis corniculata,* and different species of *rumex.* It exists uncombined in the juice of the *cicer parietinum.* In the state of *oxalate of lime* it is found in *rhubarb,* and in the roots and barks of a great variety of plants.

3. Tartaric acid is found in the pulp of the *tamarind,* in the juice of *grapes* and *mulberries*; likewise in the *rumex acetosa, rhus coriaria, rheum rhaponticum, agave americana, triticum repens, leontodon taraxacum.* In most of these plants it is in the state of supertartrate of potash.

4. Citric acid is found intermixed with other acids in the juice of *oranges* and *lemons,* and in the berries of *vaccinium oxycoccos, vaccinium vitis idæa, prunus padus, solanum dulcamara, rosa canina.* Mixed with other acids, it is common in many fruits. *Citrate of lime* is found in the onion.

5. Malic acid is very common in plants. It was found by Scheele, unmixed with any other acid, in the fruits of the following plants: the *apple, berberis vulgaris, prunus domestica, prunus spinosa, sambucus nigra, sorbus aucuparia.* Braconnot has found it in the leaves of most vegetables which he examined. Vauquelin found it in the state of *supermalate of lime* in the following plants; *sempervivum tectorum, sedum album, sedum acre, sedum telephium, arum maculatum,* and different species of *crassula* and *mesembrianthemum.* Mixed with citric acid, it constitutes the acid of the following fruits; *gooseberries, currants, bleaberries, cherries, strawberries, cloudberries, raspberries.* Sometimes, as in the tamarind, it is mixed with tartaric acid.

6. Gallic acid has been found in the bark of most

astringent tasted trees, as elm, oak, horse-chesnut, beech, willow, elder, plum, sycamore, birch, cherry-tree, mountain-ash, poplar, hazel, ash, sumach.

7. Benzoic acid has been found only in a few vegetable substances, to which the name of *balsam* has been given. The chief of these are *benzoin, balsam of Tolu, storax, dragon's blood.*

8. Prussic acid has been found in the leaves of the *lauro-cerasus,* in *peach blossoms,* in the flowers of the *sloe,* in the leaves of the bay-leaved *willow* (*salix pentandra*), and in most bitter tasted kernels.

9. Phosphoric acid is very common in plants, but only in small quantities, and it is usually combined with potash or lime. Phosphate of potash exists in barley and other species of corn, so does phosphate of lime. Both of these salts exist in the leaves of many trees.

Sect. II. *Of Sugar.*

Sugar.

Common sugar is obtained from the juice of the *arundo sacharifera* or *sugar cane,* a plant cultivated from time immemorial in India and China. It was unknown in Europe till after the conquests of Alexander the Great. The cultivation of the sugar cane was gradually introduced into Sicily and Spain, and, after the discovery of America, it was imported to the West Indian islands, where it has been cultivated to a great extent. Sugar has, in consequence, become a necessary of life among the modern nations of Europe.

How obtained.

The juice is extracted by passing the cane between iron rollers, and immediately run into a flat copper cauldron, where it is mixed with a little lime, and heated to the temperature of 140°. A thick viscid scum collects on the surface, which is left unbroken, and the clear liquid drawn from below and introduced into a large boiler. Here it is boiled briskly, the scum, as it forms, being constantly removed. From this first boiler it is passed into a second, from that to a third and fourth, in each of which the boiling is continued. When sufficiently concentrated, it is poured into a large wooden vessel called the *cooler,* where it crystallizes or *grains* as it cools. From the cooler it is taken and put into hogsheads, having a hole in the bottom, into which the stalk of a plantain leaf is thrust. Through these holes the *molasses* drain into a receiver. The sugar, thus cleared, is brought to this country under the name of *raw sugar.* It is refined by solution in water, clarified by bullock's blood, boiled down and poured into earthen cones, having a hole in the apex which is undermost. The base of the cone is covered with moist clay. From this the water slowly penetrates through the sugar, and carries off the impurities. In this state it is white, and is known by the name of *loaf sugar.*

From the experiments of Proust, it appears that sugar cane juice contains gluten, gum, extractive, a little malic acid, sulphate of lime, and two species of sugar. The object of the process is to remove all the substances, except the crystallizable sugar.

Its properties.

Sugar is a firm white substance, of an extremely sweet taste, but destitute of smell. It is but little altered by exposure to the atmosphere, though in damp air it is liable to become moist.

Cold water dissolves nearly its own weight of sugar, and boiling water dissolves any quantity whatever. The solution constitutes a thick, ropy, adhesive fluid, called syrup. When syrup is sufficiently concentrated, and kept in open vessels in a hot place, the sugar gradually crystallizes. The crystals are four or six-sided prisms, terminated by two-sided, and sometimes by three-sided summits.

The specific gravity of white sugar is 1.6065. It is not acted on by oxygen gas, by the simple combustibles, by azote, or by the metals. The alkaline earths combine with sugar, and form a compound which has a bitter and astringent taste. Sugar facilitates the solubility of lime and strontian in water; but barytes appears to act with more energy, and to occasion decomposition of sugar. The fixed alkalies combine with sugar, and form compounds similar to those formed by the alkaline earths.

The acids dissolve sugar, and the more powerful mineral acids decompose it. Nitric acid dissolves it with effervescence, converts one half of its carbon into carbonic acid, the residue assumes the form of water and oxalic acid. A quantity of malic acid is also evolved. 100 grains of sugar yield, by this treatment, 58 grains of oxalic acid. Sulphuric acid decomposes sugar, water and acetic acid are formed, and a great quantity of charcoal evolved.

Sugar dissolves in about 16 parts of boiling alcohol. If the solution be set aside, the sugar is gradually deposited in elegant crystals.

The hydrosulphurets, sulphurets, and phosphurets of alkalies and earths, seem to have the property of decomposing sugar, and of bringing it to a state not very different from that of gum.

When heat is applied to sugar, it melts, swells, becomes brownish black, emits air bubbles, and emits the smell of caromel. At a red heat it bursts into flames with a kind of explosion. When distilled, there comes over water; an acid liquid, called *pyromucous acid,* now known to be the acetic mixed with a little empyreumatic oil; an oil, and a bulky charcoal, remains in the retort. During the distillation a considerable quantity of carbonic acid and heavy inflammable air come over.

Composition according to Lavoisier.

From the experiments of Lavoisier, compared with some of our own, it appears that sugar is composed of

64	oxygen
28	carbon
8	hydrogen
100	

According to Gay-Lussac.

According to the experiments of Thenard and Gay-Lussac, the constituents of sugar are as follows:

Oxygen,	50.63
Carbon,	42.47
Hydrogen,	6.90
	100

Different kinds of sugar.

It appears from the recent researches of chemists, that there exist various species of sugar differing from each other in their properties. The most important of these are the following: Common sugar, liquid sugar, sugar of grapes, sugar of beet, manna.

Common sugar is the substance described in the preceding part of this Chapter. It is obtained from the sugar cane. The properties of the sugar of the maple are not known to differ from those of common sugar.

Liquid sugar was first pointed out by Proust. It exists in a variety of fruits and vegetable juices. It does not crystallize, and can only be exhibited in a liquid state. It is more soluble in alcohol than common sugar. It exists in the juice of the sugar-cane, and constitutes no inconsiderable portion of *molasses.*

Sugar was first extracted from grapes by the Duc de Bullion. They often yield, according to Proust, from

30 to 40 per cent. of sugar. He extracted it by saturating the acids contained in the juice of grapes with potash, boiling it down to one half, and setting it aside. Several of the salts subsided. The juice was then mixed with blood, heated, scummed, filtered, and boiled down to a syrup. Crystals of raw sugar gradually form, which may be purified by repeating the process. This sugar is white, but inferior in consistence to common sugar. It is not so sweet, and resembles sugar from honey. Like it, the sugar of grapes crystallizes in sphericles. It is less soluble than common sugar, and does not go so far in sweetening liquids.

Sugar was first extracted from the beet by Margraff. Many experiments were afterwards made upon the extraction, by Achard and other German philosophers, and attempts made to substitute the sugar of beet for common sugar, but it could not be obtained at a low enough price. It has a greater resemblance to common sugar than the sugar of grapes; but is distinguished by a certain nauseous bitter taste, owing perhaps to the presence of some foreign substance.

Manna is the produce of various trees, but is chiefly obtained from the *fraxinus ornus*, a species of *ash*, which grows abundantly in Sicily and Calabria. It partly exudes spontaneously during the summer months, and is partly obtained by incisions. The juice gradually concretes into a solid mass, or it is dried in the sun, or in stoves. Pure manna is very light, and appears to consist of a congeries of fine capillary crystals. Its taste is sweet, and it leaves a nauseous impression in the mouth. Hot alcohol dissolves it readily, and, on cooling, deposites about 5-8ths of the manna in the state of a fine light spongy crystalline mass, bearing some resemblance to camphor. This deposite may be considered as pure manna. It has an agreeable sweet taste, and instantly melts on the tongue, like snow in warm water. When dissolved in nitric acid, it yields oxalic acid. The saclactic appears also when the manna is impure. Manna does not undergo the vinous fermentation, and seems in consequence incapable of furnishing alcohol. Manna itself seems to be formed from uncrystallizable sugar by a species of fermentation.

The plants yielding sugar are very numerous. It seldom exudes spontaneously from vegetables, though this is sometimes the case.

SECT. III. *Of Sarcocoll.*

Sarcocoll.

This substance, which has hitherto been confounded with the gum resins, though its properties are very different, exudes spontaneously from the *penæa sarcocolla*, a shrub said by botanical writers to be indigenous in the north-eastern parts of Africa. It may be obtained pure by solution in alcohol, filtration, and evaporation.

Its properties.

Pure sarcocoll has a brown colour, is semitransparent, and very like gum in appearance. Its specific gravity is 1.2684.

It has a sweet taste, but leaves an impression of bitterness. It dissolves readily both in water and alcohol. The solution is yellow. It does not crystallize. When heated, it softens, but does not melt. It emits a slight smell of caromel. When strongly heated it blackens, and assumes the consistence of tar, emitting a heavy white smoke, having an acrid odour. Nitric acid dissolves it, but does not convert it into tannin. From these properties, sarcocoll appears to be intermediate between gum and sugar.

SECT. IV. *Of Asparagin.*

Asparagin

We give this name to a substance discovered in the juice of *asparagus*, by Vauquelin and Robiquet. The juice was evaporated to the consistence of a syrup, and set aside. Crystals of asparagin formed in it spontaneously.

Its properties.

These crystals are white and transparent, and have the figure of rhomboidal prisms. The greater angle of the rhomboidal base is 130°.

Asparagin is hard and brittle. Its taste is cool, and slightly nauseous, so as to occasion a secretion of saliva.

It dissolves readily in hot water, but in cold water only sparingly. Alcohol does not dissolve it.

The aqueous solution does not affect vegetable blues. Neither infusion of nutgalls, acetate of lead, oxalate of ammonia, muriate of barytes, nor hydrosulphuret of potash, occasion any change in it. When triturated with potash, no ammonia is disengaged. The potash seems to render it more soluble in water.

When heated it swells, and emits penetrating vapours, affecting the eyes and nose, like the smoke of wood. It leaves a large portion of insipid charcoal, which, when incinerated, gives scarcely a trace of residue.

Nitric acid dissolves it with the evolution of nitrous gas. The solution has a yellow colour, and a bitter taste, like that of animal substances in the same acid. Lime disengages from it a considerable quantity of ammonia.

SECT. V. *Of Gum.*

Gum.

There is a thick transparent tasteless fluid, which sometimes exudes from certain species of trees. It is very adhesive, and gradually hardens without losing its transparency, but easily softens again when moistened with water. This exudation is known by the name of gum. The gum most commonly used is that which exudes from different species of the *mimosa*, particularly the *nilotica*, and is known by the name of *gum arabic*.

How obtained.

Gum is usually obtained in small pieces like tears, moderately hard, and somewhat brittle while cold, so that it can be reduced by pounding to a fine powder. When pure it is colourless; but it has commonly a yellowish tinge, and it is not destitute of lustre. It has no smell. Its taste is insipid. Its specific gravity varies from 1.3161 to 1.4817.

Its properties.

It is not altered by exposure to the air, but the light of the sun makes it assume a white colour. Water dissolves it in large quantities. The solution, which is known by the name of *mucilage*, is thick and adhesive. It is often used as a paste, and to give stiffness and lustre to linen. When evaporated, the gum is obtained unaltered. Mucilage may be kept for years without undergoing putrefaction: at last, however, the odour of acetic acid becomes perceptible in it.

When gum is exposed to heat, it softens and swells, but does not melt; it emits air bubbles, blackens, and at last, when nearly reduced to charcoal, emits a low blue flame. A white ash remains, consisting chiefly of the carbonates of lime and potash.

Gum does not appear to be acted upon by oxygen gas, simple combustibles, azote, or the metals. The only metallic salts which occasion a precipitate when dropt into mucilage, are *nitrate of mercury*, and *acetate of lead*, both of which occasion a white precipitate. The superacetate of lead occasions no change. When oxymuriate of iron is poured into a strong mucilage, the whole is converted into a brown semitransparent jelly, which is not readily dissolved by water.

Neither the alkalies, alkaline earths, nor earthy salts, occasion any precipitate in mucilage; except silicated potash, which throws down a white flaky precipitate, even though very much diluted. The liquid remains transparent and colourless. Silicated potash is by far the most delicate test of gum that we have yet met with.

Liquid potash first converts gum into a substance not unlike curd, and then dissolves it. The solution is of a light amber colour, and transparent. When kept long, the gum falls again in the state of curd. Alcohol throws down the gum in white flakes, still soluble in water, but it retains the potash obstinately, and is much more friable than before. Lime water and ammonia likewise dissolve gum, and it may be afterwards separated little altered.

The vegetable acids dissolve gum without alteration, the strong acids decompose it. When thrown into sulphuric acid it blackens, and is decomposed. Charcoal is evolved, amounting to nearly one-third of the gum; some artificial tannin may be detected, and water and acetic acid are likewise formed. When gum is dissolved in strong muriatic acid, a brown solution is obtained, which becomes perfectly transparent when diluted with water, while at the same time some charry matter falls. If the solution be saturated with ammonia evaporated to dryness, and the residue digested in alcohol, the alcohol assumes a deep brown colour, and dissolves the whole except a little sal ammoniac. The gum now bears some resemblance to sugar in its properties, at least when heated it melts, and gives out a very strong smell of caromel.

If nitric acid be slightly heated upon gum till it has dissolved it, and till a little nitrous gas has exhaled, the solution on cooling deposites saclactic acid. Malic acid is formed at the same time, and if the heat be continued, the gum is at last changed into oxalic acid.

Gum is insoluble in alcohol. It is precipitated from water by alcohol. It is insoluble also in ether and in oils; but when triturated with a little oil, it renders the oil miscible with water.

Gum readily combines with sugar by mixing together the solutions of both in water, and evaporating to dryness. Alcohol digested on the residuum, dissolves most of the sugar; a matter remains which still has a sweetish taste, and resembles the substance of which the nests of wasps are formed.

When gum is distilled in a retort, the products are water impregnated with acetic acid and oil, or *pyromucous acid*, as it was formerly called, a little empyreumatic oil, carbonic acid gas, and heavy inflammable air. There remains in the retort charcoal containing lime and phosphate of lime. Gum yields also traces of iron when its ashes are examined, but no fixed alkali or sulphur can be detected.

Composition.

According to the analysis of Thenard and Gay-Lussac, gum is composed of

Oxygen	50.84
Carbon	42.23
Hydrogen	6.93
	100.00

Different kinds of gum.

The species of gum at present known are numerous, and a more rigid examination of the vegetable kingdom will doubtless discover a still greater number. The most remarkable are gum arabic, gum Senegal, gum tragacanth, and cherry tree gums.

Gum arabic exudes from the *mimosa nilotica*. It is the species described in the preceding part of this Chapter.

Gum Senegal.

Gum Senegal, brought from the island of that name, on the coast of Africa, often supplies the place of gum arabic in the shops. It is in larger masses than the arabic, and its colour is darker, but in other respects its properties are the same.

Gum tragacanth.

Gum tragacanth is the produce of the *astragalus tragacantha*, a thorny shrub which grows in Candia, and other islands of the Levant. It exudes about the end of June, from the stem and larger branches, and soon dries in the sun. It is in the state of whitish vermiform pieces, not nearly so transparent as gum arabic, and is exceedingly different from it in many of its properties. When put into water, it slowly imbibes a large quantity of the liquid, and forms a soft but not fluid mucilage. If the quantity of water be more than the gum can imbibe, the mucilage forms an irregular mass, which does not unite with the rest of the liquid. When tragacanth is treated with nitric acid, it yields abundance of saclactic acid, malic acid, and oxalic acid, but not the least trace of artificial tannin. When the mucilage of gum tragacanth is triturated in a mortar with water, it forms a homogeneous solution. This solution forms a precipitate with acetate and superacetate of lead and oxymuriate of tin. Nitrate of mercury throws down a slight precipitate; but neither oxysulphate of iron, nor silicated potash produce any effect. These properties show it to differ very materially from gum arabic in its properties.

Prunus avium.

The *prunus avium*, the common cherry and plum-trees, and the almond and apricot, likewise yield a gum which exudes in great abundance from natural or artificial openings in the stem. It is of a reddish brown colour, in large masses; at first much softer than gum arabic, but, by keeping, it becomes very hard. When put into water it gradually swells, and is converted into a semi-transparent reddish brown jelly. Part of it dissolves, but a part of it remains in the state of jelly, and refuses to dissolve even when boiled in water for some time. The gum dissolved is not precipitated by alcohol nor by silicated potash. Acetate of lead produces no immediate effect, but on standing the whole becomes opake, and a precipitate at last subsides. Stannane causes the liquid to gelatinize immediately. The superacetate of lead and the nitrate of mercury produce no effect. When treated with nitric acid it yields a portion of saclactic acid. These properties show a marked difference between cherry-tree gum and the other species.

SECT. VI. *Of Mucus.*

Mucus.

The substances to which we give the name of *mucus*, have been hitherto considered as varieties of gum; but, from the recent experiments of Dr Bostock, it appears that their properties differ so much from those of gum as to entitle them to a separate place as vegetable principles. They are very numerous, existing in the roots, leaves, and seeds of a great variety of plants. They scarcely ever separate spontaneously, but may be obtained artificially in a state of tolerable purity. Only a few of them have been examined. The rest are classed with these only from analogy.

Linseed yields mucus in a state of tolerable purity. When it is infused in ten times its weight of water, a fluid is obtained of the consistence of white of egg, which has the adhesive qualities of mucilage of gum arabic. When mixed with alcohol, the mucus is separated in white flocks, but the liquid does not become opake and milky like mucilage of gum arabic when mixed with alcohol. Acetate of lead throws down a copious dense precipitate. Superacetate of lead and oxymuriate of tin render the liquid opake, and also throw down a precipitate. Nitrate of mercury occasions a very slight precipitate, while muriate of gold, oxysulphate of iron, and silicated potash produce no sensible effect whatever. No change is produced by the infusion of nutgalls.

Quince seeds and the root of the hyacinth yield a mucus with the same properties, with some slight shades of difference, owing probably to the presence of foreign bodies mixed with it. The roots of the hyacinth, vernal squill, white lily, comfrey, and salop, contain so much mucus, that, when dried, they may be substituted for gum arabic. The leaves of the *malva sylvestris*, many of the fuci, and a good many of the stringy lichens, contain likewise abundance of mucus. In short, it is one of the most common of the vegetable principles. Probably there are few plants which do not yield some portion of it.

Sect. VII. *Of Jelly.*

Jelly.

How obtained.

If we press out the juice of black berries, currants, and many other fruits, and allow it to remain for some time in a state of rest, it coagulates into a tremulous soft substance, well known by the name of *jelly*. When it is washed with a small quantity of water, and then dried, we obtain it in a state approaching to purity.

Its properties.

It is nearly colourless, scarcely soluble in cold water, but very soluble in hot water, and, when the solution cools, it again coagulates into a jelly. When long boiled, it loses the property of gelatinizing, and becomes analogous to mucilage. When dried, it becomes transparent. When distilled, it yields the same products as gum. It seems very intimately connected with gum; but, as it has never been obtained in a state of complete purity, we are but imperfectly acquainted with its properties.

Sect. VIII. *Of Ulmin.*

Ulmin.

We give this name to a substance lately examined by Klaproth. It exuded spontaneously from the trunk of a species of elm, called by him the *ulmus nigra*, and was sent to Klaproth from Palermo in 1802.*

Its properties.

Externally, it has a good deal of resemblance to gum. It is solid, hard, of a black colour, and has considerable lustre. Its powder is brown. It dissolves readily in the mouth, and has an insipid taste.

Water dissolves it. The solution has a brown colour. Though very strong, it is not in the least adhesive or ropy, nor does it answer as a paste. It is insoluble in alcohol and ether, and is partially precipitated from water by alcohol.

When a few drops of nitric acid are added to the aqueous solution of ulmin, it becomes gelatinous, loses its brown colour, and a light brown substance precipitates. This precipitate is soluble in alcohol, and explodes when moderately heated. Hence, it is a compound of ulmin and nitric acid. Muriatic and sulphuric acids produce likewise yellowish brown precipitates, which are insoluble in water. Ulmin is likewise precipitated by sulphate of iron, muriate of tin, and acetate of lead, but not by nitrate of silver, nor solution of glue.

Ulmin when burnt emits little smoke or flame; it leaves a spongy but firm charcoal, which yields, when concentrated, a little carbonate of potash.

Sect. IX. *Of Inulin.*

Inulin.

We give this name to a substance discovered by Rose in the root of the *inula helenium*, or *elecampane*. When the root of this vegetable was boiled in water, the decoction, after standing some hours, deposits the *inulin* in the form of a white powder like starch.

Its properties.

It is insoluble in cold water. By trituration the inulin is uniformly diffused, and gives the liquid an opal appearance, but it soon falls down in the state of a white powder, leaving the liquid quite transparent.

It dissolves readily in hot water. One part of inulin in four parts of boiling water, formed a solution which passed readily through the filter. After some hours, the greater part of the inulin precipitates from the water in the form of a white powder.

When the aqueous solution of inulin is mixed with an equal bulk of alcohol, no change takes place for some time; but the inulin soon separates and falls to the bottom in the state of a bulky white powder. A solution of gum arabic, when treated in this manner, remains milky for days without any precipitate falling.

When thrown upon burning coals, it melts as readily as sugar, and emits a thick white smoke, not unpleasantly pungent, and similar in odour to that of burning sugar. The residue, which is but small, sinks into the coal. Starch emits a similar smoke, but leaves a more bulky residue. When exposed to a red heat, inulin burns with a vivid flame, and leaves a very small coaly residue.

When distilled, inulin yields a brown acid liquid, having the smell of pyromucous acid, but not a trace of oil.

When inulin is treated with nitric acid, it yields malic and oxalic acids, or acetic acid if too much nitric acid be employed. But no saclactic acid is formed as happens with the gums, neither is any of the waxy matter separated, which makes its appearance when starch is digested in nitric acid.

Sect. X. *Of Starch.*

Starch.

How obtained.

If a quantity of wheat flour be formed into a paste, and then held under a very small stream of water, kneading continually till the water runs off from it colourless, the flour, by this process, is divided into two distinct constituents. A tough substance of a dirty white colour, called *gluten*, remains in the hand; the water is at first milky, but soon deposits a white powder, which is known by the name of *starch*.

The starch obtained by this process is not quite free from gluten. Hence it is not very white, and has not that crystallized appearance which distinguishes the starch of commerce. Manufacturers employ a more economical and more efficacious process. Wheat is steeped in water till it gives out a milky juice when squeezed, it is then put into coarse linen sacks, which are subjected to pressure in a vessel of water till the whole starchy matter is separated. The sack and its contents are then removed. The water containing the starch gradually ferments. Vinegar and alcohol are formed in it, partly, no doubt, at the expence of the starch. The vinegar thus formed dissolves all the impurities, and leaves nothing behind but the starch. It is poured off, and the starch being

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[*] There is no doubt that ulmin exudes from the common elm, nor that it is one of the substances originally described by Vauquelin as proceeding from the ulcers to which that tree is subject.

edulcorated with water, is dried with a moderate heat. During the drying, it usually splits into columnar masses, which have a considerable degree of regularity.

Starch was well known to the ancients. According to Pliny, the method of manufacturing it was discovered by the inhabitants of Chios.

Its properties.

Starch has a fine white colour, and is usually concreted in four-sided prisms. It has scarcely any smell, and very little taste. When kept dry, it continues for a long time uninjured, though exposed to the air.

It does not dissolve in cold water, but very soon falls to powder, and forms a kind of emulsion. It dissolves in boiling water, and forms a kind of jelly, which may be diffused through boiling water; but when the mixture is allowed to stand a sufficient time, the starch slowly precipitates to the bottom. The subsidence takes place even when 90 parts of water are employed to dissolve one of starch; but, in that case, at least a month elapses before the starch begins to precipitate. The solution is glutinous in proportion to the quantity of starch. Linen dipt into it and suddenly dried, acquires a considerable degree of stiffness. When the solution is evaporated to dryness, a brittle opake mass is obtained, differing in appearance from common starch, but exhibiting nearly the same properties with re-agents. Hence the apparent difference is probably owing to a portion of water remaining united to the boiled starch. When the solution of starch is left exposed to damp air, it soon loses its consistency, acquires an acid taste, and becomes mouldy on the surface.

Starch does not dissolve, nor even fall to powder in alcohol. Neither does it dissolve in ether.

Neither oxygen gas nor the simple combustibles have any marked action on starch. The metals and their oxides have little affinity for it. Acetate of lead throws it down from water, but the superacetate has no effect upon it. According to Dr Bostock, it is precipitated also by oxymuriate of tin; but in the trials made by the writer of this article, he obtained no precipitate with that salt in a decoction containing one-ninetieth of its weight of starch. No other metallic salt tried produced a precipitate in this decoction.

Neither lime nor strontian water precipitate the decoction of starch; but barytes water throws down a copious white flaky precipitate. It is dissolved by muriatic acid, but appears again on standing, unless a considerable excess of acid be added. Neither muriate of barytes nor silicated potash occasion any precipitate in the decoction of starch.

When starch is triturated in a hot infusion of nutgalls, a complete solution is effected. This solution is transparent, and rather lighter coloured than the infusion of nutgalls employed. When this solution cools, it becomes opake, and a copious curdy precipitate falls. A heat of 120° re-dissolves this precipitate, and renders the solution transparent, but it is deposited again as the liquid cools. This property is characteristic of starch. The infusion of nutgalls throws it down from every solution, but the precipitate is re-dissolved by heating the liquid to 120°. The precipitate is a compound of tannin and starch, and is least soluble when composed of about three parts starch, and two parts tannin. It has a brownish yellow colour, is semi-transparent, has an astringent taste, and feels glutinous between the teeth like gum.

When potash is triturated with starch, and a little water added, the whole assumes, on standing, the appearance of a semi transparent jelly. On adding water, an opal coloured solution is obtained, from which the starch is readily thrown down by an acid. When muriatic acid is employed, a peculiar aromatic odour is perceived. The decoction of starch is neither altered by potash, carbonate of potash, nor ammonia.

When starch is thrown into any of the mineral acids, at first no apparent change is visible; but, if an attempt is made to reduce the larger pieces, while in acids, to powder, they resist it, and feel exceedingly tough and adhesive. Sulphuric acid dissolves it slowly, and at the same time a smell of sulphuric acid is emitted, and such a quantity of charcoal evolved, that the vessel may be inverted without spilling any of the mixture. Diluted sulphuric acid dissolves starch when assisted by heat, and the starch may be again precipitated by means of alcohol.

Diluted nitric acid slowly dissolves starch; the acid acquires a green colour, and a small portion of white matter swims on the surface, on which the acid does not act. Alcohol throws down the starch from this solution. Concentrated nitric acid dissolves starch pretty rapidly, assuming a green colour, and emitting nitrous gas. The solution is never complete, nor do any crystals of oxalic acid appear unless heat be applied. In this respect starch differs from sugar, which yields oxalic acid even at the temperature of the atmosphere. When heat is applied to the solution of starch in nitric acid, both oxalic and malic acids are formed, but the undissolved substance still remains. When separated by filtration, and afterwards edulcorated, this substance has the appearance of a thick oil not unlike tallow; but it dissolves readily in alcohol. When distilled it yields acetic acid and an oil, having the smell and consistence of tallow.

Strong muriatic acid dissolves starch slowly and without effervescence. When the starch does not exceed one-twentieth of the acid, the solution is colourless and transparent; but if we continue to add starch, a brown colour appears, and the acid loses a portion of its fluidity. Its peculiar smell is destroyed, and replaced by the odour which may be perceived in corn mills. Acetic acid does not dissolve starch. The action of the other acids has not been tried.

Alcohol separates starch in part from its decoction. A solution of potash in alcohol occasions a copious white precipitate, which is re-dissolved on adding a sufficient quantity of water. A solution of sulphuret of potash in alcohol occasions a flaky precipitate in the decoction of starch. This precipitate has sometimes an orange colour.

When starch is thrown upon a hot iron, it melts, blackens, froths, swells, and burns with a bright flame like sugar, emitting at the same time a great deal of smoke; but it does not explode, nor has it the caromel smell which distinguishes burning sugar. When distilled, it yields water, impregnated with an acid supposed to be the pyromucous, a little empyreumatic oil, and a great deal of carbonic acid and heavy inflammable air. The charcoal which it leaves burns easily when kindled in the open air, and leaves very little ashes. According to the experiments of Thenard and Gay-Lussac, it is composed of

Composition.

Oxygen	49.68
Carbon	43.55
Hydrogen	6.77
	100

Starch is contained in a great variety of vegetable substances; most commonly in their seeds or bulbous roots, but sometimes also in other parts. All the different species of corn contain a great proportion of it. There are obviously different varieties of starch, possessing distinct properties. But hitherto these varieties have not been examined with such attention as to enable us to give a detailed description of each.

SECT. XI. *Of Indigo.*

Indigo.

This valuable pigment, one of the capital manufactures of America, is obtained from the leaves of different species of plants: the *indigofera argentea* or *wild indigo*, the *indigofera disperma* or *Guatimala indigo*, and the *indigofera tinctoria* or *French indigo*, which yields the greatest quantity of indigo, and is therefore preferred by the planter, though its quality is said to be inferior to that of the indigo obtained from the two first species. In the West Indies the seeds are sown in March, in trenches about a foot asunder, and the plant comes into blossom, and is fit for cutting down in May. But in South America, six months elapse before it can be cut. In the West Indies, four cuttings are often obtained from the same plant in the course of a year; but in America, never more than two, and often only one. The produce constantly diminishes after the first cutting, so that it is necessary to renew the plants for seed every year.

How obtained.

The plants are cut down with sickles, and laid in strata in the *steeper* till it is about three parts full. This is a large cistern of wood or mason work about 16 feet square. Here they are pressed down with planks, and loaded to prevent them from swimming, and covered with water to the height of four or five inches. Here they ferment, and the utmost attention is required to the process. If they be allowed to remain too long, the pigment is spoiled; and if the water be drawn off too soon, much of the indigo is lost. The temperature of 80° is said to answer best. The water acquires a green colour, a smell resembling that of ammonia is exhaled, and bubbles of carbonic acid are emitted. When the fermentation has continued long enough, the liquor is let out into a second cistern placed lower than the first; this cistern is called the *battery*, and is commonly above 12 feet square, and four and a half deep. Here it is agitated for 15 or 20 minutes, by means of levers driven by machinery, till the flocculi beginning to separate give it a curdled appearance. A quantity of lime-water is now poured in, and the blue flocculi are allowed to subside. The water is then drawn off, and the pigment put to be drained in small linen bags, after which it is put into little square boxes, and allowed to dry in the shade.

Chevreul has shown, that the indigo exists in the plant chiefly in the state of a white matter, which becomes blue when it combines with oxygen. Indigo may be obtained also from other plants, the *nerium tinctorium*, for example, and the *isatis tinctoria*, or *woad*, a plant common enough in Britain. But the quantity obtained from this plant does not exceed one-tenth of what may be procured from the *indigofera*.

Its properties.

Indigo is a fine light friable substance of a deep blue colour. Its texture is very compact, and the shade of its surface varies according to the manner in which it has been prepared. The principal tints are copper, violet, and blue. The lightest indigo is the best; but it is always mixed with foreign substances, scarcely one half even of the best indigo of commerce consisting of the pure pigment. The following substances were extracted by Chevreul from 100 parts of Guatimala indigo:

Composition of Guatimala indigo.

Ammonia, a trace	
Disoxygenized indigo . . .	12
Green matter	30
Bitter matter, a trace	
Red matter	6
Carbonate of lime	2
Oxide of iron and alumina . .	2
Silica	3
Pure indigo	45
	100

Pure indigo has neither taste nor smell. It is insoluble in water in its usual state, but disoxygenized indigo is soluble in that liquid, as are likewise some of the foreign bodies with which indigo is usually mixed. When heated, indigo sublimes in a purple smoke, and may be obtained unaltered crystallized in needles. This purple smoke is characteristic of indigo.

Neither oxygen nor the simple combustibles have any action on common indigo; but disoxygenised indigo readily combines with oxygen, and may be separated again from it without decomposition. In this respect it differs from almost all other vegetable substances, and approaches the properties of the simple combustibles and metals.

The fixed alkaline solutions have no effect upon indigo, except it be newly precipitated from a state of solution. In that case they dissolve it with facility. The solution has at first a green colour, which gradually disappears, and the natural colour of the indigo cannot be again restored. Hence we see, that the alkalies when concentrated decompose indigo. Pure liquid ammonia acts in the same way. Even carbonate of ammonia dissolves precipitated indigo, and destroys its colour.

Lime-water has scarcely any effect upon indigo in its usual state, but it dissolves precipitated indigo. The solution is at first green, but it becomes gradually yellow.

When diluted sulphuric acid is digested over indigo, it produces no effect except that of dissolving the impurities; but concentrated sulphuric acid dissolves it readily. One part of indigo, when mixed with eight parts of sulphuric acid, evolves heat, and is dissolved in 24 hours. The solution of indigo is well known in this country by the name of *liquid blue*. Bancroft calls it *sulphate of indigo*. While concentrated, it is opake and black; but when diluted, it assumes a fine deep blue colour, and its intensity is such, that a single drop of the concentrated sulphate is sufficient to give a blue colour to many pounds of water. Bergman ascertained the effect of different reagents on this solution with great precision. His experiments threw light not only on the properties of indigo, but upon the phenomena that take place when it is used as a dye-stuff.

From his experiments, it is obvious that all those substances which have a very strong affinity for oxygen give a green colour to indigo, and at last destroy it. Hence it is extremely probable, that indigo becomes green by giving out oxygen. Of course it owes its blue colour to that principle. This theory was first suggested by Mr Hauseman, and still farther confirmed by Berthollet. Now it is only when green that it is in a state capable of being held in solution by lime, alkalies, &c. in which state it is applied as a dye to cloth. The cloth, when dipt into the vat containing it thus dissolved, combines with it, and the blue colour is restored by exposure to the atmosphere. It may be restored equally by plunging the cloth into oxymuriatic acid. Hence the restoration cannot but be ascribed to oxygen. Hence then the reason that sulphurous acid, the vegetable acids, sulphate of iron, give sulphate of indigo a green colour.

From these experiments, we see also that the colour of indigo is destroyed by the addition of those substances which part with oxygen very readily, as the black oxide of manganese. In that case the indigo is destroyed, for its colour cannot be again restored. When the sulphate of indigo is poured into boiling water, it affords a green-coloured solution; but with cold water a deep blue solution. What is called smoking sulphuric acid dissolves indigo much more readily than the pure acid, and evolves much more heat during the solution. Bucholz has shown, that by boiling sulphur in pure sulphuric acid, it acquires the property of dissolving indigo as readily as the smoking acid.

Nitric acid attacks indigo with great violence; with the evolution of abundance of heat and nitrous gas. When of the specific gravity 1.52, it even sets fire to indigo. When the acid is diluted, the action is still violent, unless the proportion of water be considerable. Mr Hatchett poured upon 100 grains of indigo an ounce of nitric acid, diluted with an equal quantity of water. The action was so rapid, that he found it necessary to add another ounce of water. When the effervescence had nearly subsided, the liquid was placed on a sand bath for some days, and evaporated to dryness. Water poured upon the residuum dissolved a considerable portion of it, and formed a beautiful deep yellow solution of an intense bitter taste. This solution contains only a very small portion of oxalic acid; but with a solution of isinglass it forms a copious yellow insoluble precipitate, and of course contains a portion of artificial tannin. With ammonia crystals precipitate, consisting of *bitter principle* combined with ammonia.

When four parts of nitric acid are boiled upon one part of indigo, the pigment soon loses its colour, and is dissolved. The solution becomes yellow, and a thin layer of a resinous matter appears on the surface. If the process be now stopt, the resinous matter becomes thin by cooling. If this matter be removed, and the solution evaporated to the consistence of honey, redissolved in hot water and filtered, potash throws down yellow spicular crystals, consisting of *bitter principle* combined with potash. These crystals have the curious property of detonating with a purple light, when wrapt up in paper, and struck with a hammer; the resin, by treating it with fresh nitric acid, may be converted into the same bitter principle. If the process be stopt sooner than the point mentioned above, yellow crystals are obtained, which are more soluble in water, and which sublime in white needles, having all the properties of benzoic acid.

Muriatic acid does not act upon indigo in its common state, but it readily dissolves indigo precipitated from the sulphate, and forms a blue-coloured solution. The same phenomena are exhibited by the phosphoric, acetic, tartaric acids, and probably by all except the acid supporters.

Chlorine destroys the colour of indigo as readily as nitric acid.

Alcohol dissolves a small portion of indigo, but it gradually precipitates again unless *red matter* be present, in which case the solution is permanent.

Indigo is not acted upon by ether or oils, at least if the experiments of Bergman be accurate.

When indigo is mixed with bran, woad, and other similar substances which readily undergo fermentation, it assumes a green colour during the fermentation, and is then easily dissolved by lime or potash. It is by this process that it is usually rendered proper for dyeing.

SECT. XII. *Of Gluten.*

Gluten.

If wheat-flour be kneaded into paste with a little water, it forms a tenacious, elastic, soft, ductile mass. This is to be washed cautiously, by kneading it under a small jet of water, till the water no longer carries off any thing, but runs off colourless; what remains behind is called *gluten*. It was discovered by Beccaria, an Italian philosopher, to whom we are indebted for the first analysis of wheat-flour.

How obtained.

Its properties.

Gluten, when thus obtained, is of a grey colour, exceedingly tenacious, ductile, and elastic, and may be extended to twenty times its original length. When very thin, it is of a whitish colour, and has a good deal of resemblance to animal tendon or membrane. Its smell is peculiar. It has scarce any taste, and does not lose its tenacity in the mouth.

When exposed to the air, it gradually dries; and when completely dry, it is pretty hard, brittle, slightly transparent, of a dark brown colour, and has some resemblance to *glue*.

Fresh gluten imbibes water, and retains a certain quantity of it with great obstinacy. To this water it owes its elasticity and tenacity. When boiled in water it loses both these properties.

When fresh gluten is macerated for a considerable time in cold water, the liquid becomes opake, and contains small films suspended, which do not soon subside. By repeated filtrations it becomes transparent; but it holds in solution gluten, which renders it frothy, and gives it the property of precipitating when mixed with oxymuriatic acid or the infusion of nutgalls. Thus gluten is to a certain extent soluble in cold water. When the water is heated, the gluten separates in the state of yellow flakes.

When kept moist, it very soon begins to decompose, and to undergo a species of fermentation. It swells, and emits air-bubbles, which Proust has ascertained to consist of hydrogen and carbonic acid gases. It emits also a very offensive odour, similar to what is emitted by putrefying animal bodies. Cadet kept gluten in a vessel for a week in a damp room. Its surface became covered with byssi, the fermentation just mentioned had commenced, and the odour was distinctly acid. In 24 days, on removing the upper crust, the gluten was found converted into a kind of paste, of a greyish-white colour, not unlike bird-lime. In that state he gave it the name of *fermented gluten*. If the gluten be still left to itself, it gradually acquires the smell and the taste of *cheese*. This curious fact was first ascertained by Rouelle junior. In that state it is full of holes, and contains the very same juices which distinguish some kinds of cheese. Proust ascertained that it contains ammonia and vinegar; bodies which Vauquelin detected in cheese; and ammonia robs both equally of their smell and flavour.

Fresh gluten does not sensibly dissolve in alcohol, which even throws down fresh gluten from water; yet in certain cases this liquid forms a solution of gluten in very small proportion.

Fermented gluten.

When the *fermented gluten* of Cadet is triturated with a little alcohol into a mucilage, and then mixed with a sufficient quantity of that liquid, a portion of it is dissolved. This solution constitutes an excellent varnish, possessed of considerable elasticity. It may be spread over paper or wood; and when dry resists other bodies, as well as most varnishes. In this state, too, it may be employed to cement china; and triturated with paints, especially vegetable colours, it forms a very good groun

When this solution is mixed with a sufficient quantity of lime, it forms a very good lute; and bits of linen dipt in it adhere very strongly to other bodies.

Ether does not sensibly dissolve gluten.

Acids act upon gluten differently, according to the peculiar properties of each.

Concentrated acetic acid dissolves it readily in considerable quantity, and without altering its nature. The solution is muddy, but permanent; and the gluten may be thrown down by means of alkalies. This acid dissolves the fermented gluten of Cadet; and the solution may be substituted for the solution in alcohol as a varnish; but it does not answer to mix it with colours.

Concentrated sulphuric acid renders it violet coloured, and at last black; inflammable air escapes, and charcoal, water, and a portion of ammonia, are formed. When nitric acid is poured on it, and heat applied, there is a quantity of azotic gas emitted; and by continuing the heat, some little oxalic acid is formed, and likewise malic acid, while a number of yellow-coloured oily flakes make their appearance in the solution.

Muriatic acid dissolves gluten with facility when its action is assisted by heat. When gluten is placed in oxymuriatic acid, it softens, and seems to dissolve, but soon coagulates again into yellow-coloured flakes, which become transparent and greenish-coloured by drying. When heated, they exhale oxymuriatic acid, and assume the appearance of common gluten. This acid has the property of precipitating gluten from water in the state of yellowish-white flakes.

Alkalies dissolve gluten when they are assisted by heat. The solution is never perfectly transparent. Acids precipitate the gluten from alkalies, but it is destitute of its elasticity. Alkalies, when much concentrated, form with it a kind of soap, converting it into oil and ammonia; which last is dissipated during the trituration.

Gluten is precipitated from water, and from some of its other solutions, by the infusion of nutgalls. The colour of the precipitate is usually yellowish-brown, and it does not dissolve though the solution be heated.

When moist gluten is suddenly dried, it swells amazingly. Dry gluten, when exposed to heat, cracks, swells, melts, blackens, exhales a fetid odour, and burns precisely like feathers or horn. When distilled, there come over water impregnated with ammonia and an empyreumatic oil; the charcoal which remains is with difficulty reduced to ashes.

SECT. III. *Of Albumen.*

Albumen. Albumen is the term by which chemists have agreed to denote the *white of egg*, and all glary tasteless substances which, like it, have the property of coagulating into a white, opaque, tough, solid substance, when heated a little under the boiling point. This substance forms a constituent of many of the fluids of animal bodies; and when coagulated, it constitutes also an important part of their solids. Substances analogous to it had been noticed by chemists in the vegetable kingdom. Scheele affirmed, as early as 1780, that the greater number of plants contained a substance analogous to curd. Fourcroy, about the year 1790, announced the existence of albumen in a variety of plants; but Proust has since shewn, that the substance which he took for albumen, and which had been already examined by Rouelle, was not possessed of the properties which characterise that animal matter. But Vauquelin has lately discovered albumen in abundance in the juice of the papaw tree; so that its existence as a vegetable principle cannot be disputed.

The *papaw tree*, the *carica papaya* of botanists, grows in Peru, &c. and in the Isle of France, where the milky juice that exudes from it is said to be employed with efficacy against the *Guinea worm*. Two specimens of this juice were brought from that island to Paris by Charpentier de Cossigny. In the one, the juice had been evaporated to dryness, and was in the state of an extract; in the other, the juice was preserved by being mixed with an equal bulk of rum. Both were subjected to a chemical analysis by Vauquelin. The first was of a yellowish-white colour, and semitransparent. Its taste was sweetish. It had no smell, and was pretty solid; but attracted moisture when kept in a damp place. The second was reddish brown, and had the smell and taste of boiled beef. When the first specimen was macerated in cold water, the greatest part of it dissolved. The solution frothed with soap. The addition of nitric acid coagulated it, and rendered it white; and when boiled, it threw down abundance of white flakes. These flakes were coagulated albumen.

Other specimens of this juice, both in the liquid and dried state, have been examined more recently by Vauquelin, and likewise by Cadet.

The essential characters of albumen are the following:

Its properties. In its natural state it is soluble in water, and forms a glary limpid liquid, having very little taste; which may be employed as a paste, and which forms a very shining varnish.

The solution is coagulated by acids, pretty much in the same way as milk is coagulated by the same re-agents.

When not too much diluted, it is coagulated also when heated to the temperature of 176°.

Albumen dissolved in water is precipitated in the state of brown flakes by the infusion of tan.

The solution is equally coagulated when mixed with alcohol.

Albumen is precipitated from water in the state of white powder by the salts of most of the white metals; such as silver, mercury, lead, tin, &c.

The juice of the papaw possessed all these properties. It therefore contained albumen. In few other vegetable productions has this substance been yet found in such abundance, or in a state in which its properties were so decidedly characteristic; but the resemblance between the curd of milk and albumen is very close, as we shall see afterwards. Now, Proust has ascertained that *almonds*, and other similar kernels from which *emulsions* are made, contain a substance which has the properties of curd.

Albumen, when burnt, emits ammonia; and when treated with nitric acid, yields azotic gas. It evidently, then, contains azote. But as it is more properly an animal than a vegetable substance, we shall defer giving any farther account of its properties till we come to treat of animal bodies.

SECT. XIV. *Of Fibrin.*

Fibrin. That peculiar substance which constitutes the fibrous part of the muscles of animals, has been called *fibrin* by chemists. A substance resembling it, as it exists in the blood, has been detected by Vauquelin in the juice of the papaw tree; the same juice which contained albumen in such plenty. Fibrin, then, must be ranked among vegetable substances.

When the juice of the papaw is treated with water, the greatest part dissolves; but there remains a substance insoluble, which has a greasy appearance. It softens in the air, and becomes viscid, brown, and semitransparent. When thrown on burning coals, it melted, let drops of grease exude, emitted the noise of meat roasting, and produced a smoke which had the odour of fat volatilized. It left behind it no residue. This substance was the *fibrin*. The resemblance between the juice of the papaw and animal matter is so close, that one would be tempted to suspect some imposition, were not the evidence that it is really the juice of a tree quite unexceptionable.

The properties of fibrin are the following:

Its properties.

1. It is tasteless, fibrous, elastic, and resembles gluten.
2. It is insoluble in water and in alcohol.
3. It is not dissolved by diluted alkalies.
4. But acids dissolve it without difficulty.
5. With nitric acid it gives out much azotic gas.
6. When distilled it yields much carbonate of ammonia and oil.
7. It soon putrefies when kept moist, becomes green, but does not acquire any resemblance to cheese.

SECT. XV. *Of the Bitter Principle.*

Bitter principle.

Many vegetable substances have an intensely bitter taste, and on that account are employed in medicine, by brewers, &c. This is the case with the wood of the *quassia amara* and *excelsa*, the common *quassia* of the shops; with the roots of the *gentiana lutea*, common *gentian;* the leaves of the *humulus lupulus*, or *hop;* the bark and wood of the *spartium scoparium*, or common broom; the flowers and leaves of the *anthemis nobilis* or *chamomile;* and many other substances. Some of these bodies owe their bitter taste to the presence of a peculiar vegetable substance differing from every other, which may be distinguished by the name of the *bitter principle.*

No chemical examination of this substance has been hitherto published; nor, indeed, are we in possession of any method of separating it from other bodies, or of ascertaining its presence. At the same time, it cannot be doubted that it possesses peculiar characters; and its action on the animal economy renders it an object of importance.

How obtained.

I. When water is digested over *quassia* for some time, it acquires an intensely bitter taste, and a yellow colour, but no smell. When water thus impregnated is evaporated to dryness in a low heat, it leaves a brownish-yellow substance, which retains a certain degree of transparency. It continues ductile for some time, but at last becomes brittle. This substance we shall consider as the bitter principle in a state of purity. If it contains any foreign body, it must be in a very minute proportion. This substance was found by the writer of this article to possess the following properties:

Its properties.

1. Its taste is intensely bitter. Colour brownish-yellow.
2. When heated, it softens, and swells, and blackens; then burns away without flaming much, and leaves a small quantity of ashes.
3. Very soluble in water and alcohol.
4. Does not alter the colour of infusion of litmus.
5. Lime-water, barytes-water, and strontian-water, occasion no precipitate. Neither is any precipitate thrown down by silicated potash, aluminated potash, or sulphate of magnesia.
6. The alkalies occasion no change in the diluted solution of the bitter principle.
7. Oxalate of ammonia occasions no precipitate.
8. Nitrate of silver renders the solution muddy, and a very soft flaky yellow precipitate falls slowly to the bottom.
9. Neither corrosive sublimate nor nitrate of mercury occasion any precipitate.
10. Nitrate of copper, and the ammonial solution of copper, produce no change; but muriate of copper gives the white precipitate, which falls when this liquid salt is dropt into water.
11. Sulphate and oxymuriate of iron occasion no change.
12. Muriate of tin renders the solution muddy, but occasions no precipitate, unless the solution be concentrated; in that case a copious precipitate falls.
13. Acetite of lead occasions a very copious white precipitate; but the nitrate of lead produces no change.
14. Muriate of zinc occasions no change.
15. Nitrate of bismuth produces no change, though when the salt is dropt into pure water a copious white precipitate appears.
16. Tartar emetic produces no change; but when the muriate of antimony is used, the white precipitate appears, which always falls when this salt is dropt into pure water.
17. Muriate and arseniate of cobalt occasion no change.
18. Arseniate of potash produces no effect.
19. Tincture of nutgalls, infusion of nutgalls, gallic acid, occasion no effect.

These properties are sufficient to convince us that the bitter principle is a substance differing considerably from all the other vegetable principles. The little effect of the different re-agents is remarkable. Nitrate of silver and acetate of lead are the only two bodies which throw it down. This precipitation cannot be ascribed to the presence of muriatic acid; for if muriatic acid were present, nitrate of lead would also be thrown down.

Another species of bitter principle.

II. Besides this purest species of bitter principle, it is probable that several others exist in the vegetable kingdom, gradually approaching by their qualities to the nature of *artificial tannin.* The second species is distinguished from the preceding, by the property which it has of striking a green colour with iron, and of precipitating that metal from concentrated solutions.

How obtained.

Mr Chenevix separated a portion of it from coffee by the following process: He digested unburnt coffee in water, and filtered the liquid. It was then treated with muriate of tin. The precipitate was edulcorated, mixed with water, and treated with sulphureted hydrogen gas. The tin was thus precipitated, and the substance with which it had been combined was dissolved by the water. The liquid was then evaporated to dryness. The substance thus obtained possessed the following properties:

Its properties.

1. Semitransparent like horn, and of a yellow colour.
2. When exposed to the air it does not attract moisture.
3. Soluble in water and in alcohol. The solution in water is semitransparent, and has a pleasant bitter taste. When the alkaline solutions are dropt into it, the colour becomes garnet red.
4. It is not precipitated from water by the alkaline carbonates. Sulphuric acid renders the solution brown, but produces no further change. Neither muriatic acid, nor phosphoric acid, nor the vegetable acids, produce any change on this solution.
5. The muriates of gold, platinum, and copper, occasion no change.
6. With solutions of iron it forms a fine green colour-

ed liquid; and when concentrated, iron throws down a green coloured precipitate. Indeed, it is almost as delicate a test of iron as tan and gallic acid.

7. Muriate of tin throws down a copious yellow precipitate. This precipitate, and that by iron, are soluble in all acids, but they lose their colour.

8. Neither lime nor strontian water occasion any precipitate in the aqueous solutions of this substance; but barytes water occasions a brown precipitate.

9. Gelatine occasions no precipitate.

Artificial bitter principle.

III. The third species may be distinguished by the name of *artificial bitter principle*, as it has been formed by the action of nitric acid on various vegetable and animal substances. It was first obtained by Haussman, while examining indigo, but he mistook its nature. Welther afterwards formed it by digesting silk in nitric acid, ascertained its properties, and gave it the name of *yellow bitter principle*; he is therefore to be considered as the real discoverer. Bartholdi afterwards procured it by treating the *white* willow with nitric acid. Mr Hatchett lately obtained it during his experiments on artificial tannin, by treating indigo with nitric acid; and about the same time Fourcroy and Vauquelin procured it by the same means, and examined its properties in detail. This substance possesses the following properties:

How obtained.

Its properties.

Its colour is a deep yellow, its taste intensely bitter. It is soluble both in water and alcohol, and has the property of dyeing silk, woollen cloth, and cotton, of a durable yellow colour. It crystallizes in elongated plates, and possesses many of the characters of an acid, combining readily with alkaline substances, and forming crystallizable salts. When potash is dropt into a concentrated solution of it, small yellow prismatic crystals are gradually deposited, consisting of bitter principle combined with potash. These crystals were examined by Welther, but it was Fourcroy and Vauquelin that ascertained their composition. They have a bitter taste, are not altered by exposure to the air, are less soluble than pure bitter principle. When thrown upon hot charcoal they burn like gunpowder, and detonate very loudly when struck upon an anvil, emitting a purple light. Ammonia dropt into the solution of bitter principle deepens its colour, and occasions a copious deposition of fine yellow spicular crystals. These are a combination of bitter principle and ammonia.

IV. Artificial tannin itself may be considered as approaching the bitter principle in many of its properties. Its taste is always intensely bitter, and the colour of the precipitates which it throws down from the metals, is similar to what takes place when artificial bitter principle is present. It is indeed possible, that the bitter taste may be owing not to the tannin, but to a portion of artificial bitter principle, which may be always formed along with the tannin; but this has not been ascertained. It is well known, that the bitter taste very easily overpowers and conceals all other tastes.

SECT. XVI. *Of Tannin.*

Tannin.

Notwithstanding the numerous experiments made upon the infusion of nutgalls, we are not in possession of a process capable of furnishing tannin in a state of purity. Hence the obscurity which still hangs over its characters. The properties of this substance, as far as known, and the different methods of procuring it hitherto proposed by chemists, have been detailed in a preceding part of this article.

Like most other vegetable substances, it seems to be susceptible of different modifications. The following are the different species of tannin which have been hitherto noticed:

Different species of tannin.

1. Tannin from nutgalls. This is the common species described in this article under the name of tannin. It precipitates iron black, and forms a firm insoluble brown precipitate with glue. The bark of oak, and most other astringent trees in this country, are supposed at present to contain this species of tannin.

2. The tannin which constitutes so large a proportion of catechu forms the second species. Its peculiar nature was first observed by Proust. It was afterwards more particularly examined by Mr Davy. It forms with iron an olive coloured precipitate.

3. The tannin of *kino* constitutes a third species. This substance is obtained from different vegetables. It was originally imported, as is supposed, from Africa; but at present the common kino of the shops is, according to Dr Duncan, an extract from the *coccoloba urifera*, or *sea-side grape*, and is brought chiefly from Jamaica. But the finest kino is the product of different species of *eucalyptus*, particularly the *resinifera*, or brown gum-tree of Botany Bay. It is an astringent substance of a dark red colour, and very brittle. It dissolves better in alcohol than water. The solution in the latter liquid is muddy; in the former transparent, and a fine crimson if sufficiently diluted. It throws down gelatine of a rose colour, and forms with salts of iron a deep green precipitate, not altered by exposure to the air.

4. The fourth variety of tannin is contained in *sumach*. This is a powder obtained by drying and grinding the shoots of the *rhus coriaria*; a shrub cultivated in the southern parts of Europe. The tan, which it contains in abundance, yields a precipitate with gelatine, which subsides very slowly, and remains in the state of a white magma without consistence.

5. The fifth variety, according to Proust, is to be found in the wood of the *morus tinctoria*, or *old fustic*, as the British dyers term it. This wood gives out an extract both to alcohol and water, which yields a precipitate with gelatine. A solution of common salt is sufficient to throw it down.

SECT. XVII. *Of the Extractive Principle.*

Extractive principle.

The word *extract* was at first applied to all those substances which were extracted from plants by means of water, and which remained behind in the state of a dry mass when the water was evaporated; consequently it included gum, jelly, and several other bodies. But, of late, it has been confined by many to a substance which exists in many plants, and which may be obtained nearly in a state of purity, according to Hermbstadt, by infusing *saffron* in water for some time, filtrating the infusion, and evaporating it to dryness. But as the word *extract* occurs even in modern authors in its original sense, we shall rather denote this substance by the phrase *extractive principle*, to prevent ambiguity.

The difficulty of obtaining the extractive principle in a separate state, and the facility with which it alters its nature, have hitherto prevented chemists from examining it with that attention to which it is entitled. It was first particularly attended to by Rouelle; but it is to Fourcroy and Vauquelin that we are chiefly indebted for ascertaining its characters. The dissertation of Vauquelin, in the *Journal de Pharmacie*, is by far the best account of extractive matter which has hitherto appeared. Many valuable facts and curious observations were published by Hermbstadt, also, in his dissertation on *extract*. But, unfortunately, the term has not been always taken by chemists in the same acceptation. Parmentier has lately published a dissertation on the *extracts* of vegetables, taken in the loose and general sense of the word, which contains much information.

The extractive principle possesses the following properties:

Its properties.

Soluble in water, and the solution is always coloured. When the water is slowly evaporated, the extractive matter is obtained in a solid state and transparent; but when the evaporation is rapid the matter is opake.

The taste of extractive is always strong; but it is very different according to the plant from which it is obtained.

Soluble in alcohol, but insoluble in ether.

By repeated solutions and evaporations, the extractive matter acquires a deeper colour, and becomes insoluble in water. This change is considered as the consequence of the absorption of the oxygen of the atmosphere, for which the extractive principle has a strong affinity. But if the solution be left to itself, exposed to the atmosphere, the extract is totally destroyed in consequence of a kind of putrefaction which speedily commences.

When oxymuriatic acid is poured into a solution containing extractive, a very copious dark yellow precipitate is thrown down, and the liquid retains but a light lemon colour. These flakes are the oxygenized *extractive.* It is now insoluble in water; but hot alcohol still dissolves it.

The extractive principle unites with alumina, and forms with it an insoluble compound. Accordingly, if sulphate, or muriate of alumina, be mixed with a solution of extractive, a flaky insoluble precipitate appears, at least when the liquid is boiled; but if an excess of acid be present, the precipitate does not always appear.

It is precipitated from water by concentrated sulphuric acid, muriatic acid, and probably by several other acids. When the experiment is made with sulphuric acid, the fumes of vinegar generally become sensible.

Alkalies readily unite with extractive, and form compounds which are insoluble in water.

The greater number of metallic oxides form insoluble compounds with extractive. Hence, many of them, when thrown into its solution, are capable of separating it from water. Hence also, the metallic salts mostly precipitate extractive. Muriate of tin possesses this property in an eminent degree. It throws down a brown powder perfectly insoluble, composed of the oxide of tin and vegetable matter.

If wool, cotton, or thread, be impregnated with alum, and then plunged into a solution of extractive, they are dyed of a fawn colour, and the liquid loses much of its extractive matter. This colour is permanent. The same effect is produced, if muriate of tin be employed instead of alum. This effect is still more complete, if the cloth be soaked in oxymuriatic acid, and then dipt into the infusion of extractive. Hence we see that the extractive matter requires no other mordant, than oxygen to fix it on cloth.

When distilled, extractive yields an acid liquid impregnated with ammonia.

It cannot be doubted, that there are many different species of extractive matter; though the difficulty of obtaining each separately has prevented chemists from ascertaining its nature with precision. Extracts are usually obtained by treating the vegetable substance from which they are to be procured with water, and then evaporating the watery solution slowly to dryness. All extracts obtained by this method have an acid taste, and redden the infusion of litmus. They all yield a precipitate while liquid, if they are mixed with ammonia. This precipitate is a compound of lime and insoluble extractive. Lime always causes them to exhale the odour of ammonia. It has been ascertained, that the extractive principle is more abundant in plants that have grown to maturity than in young plants.

Sect. XVIII. *Of the Narcotic Principle.*

Narcotic principle.

It has been long known that the milky juices which exude from certain plants, as the poppy, lettuce, &c. and the infusions of others, as of the leaves of the *digitalis purpurea*, have the property of exciting sleep, or, if taken in large enough dozes, of inducing a state resembling apoplexy, and terminating in death. How far these plants owe these properties to certain common principles which they possess is not known; though it is exceedingly probable that they do. But as a *peculiar substance* has been detected in *opium*, the most noted of the narcotic preparations, which possesses narcotic properties in perfection, we are warranted, till further experiments elucidate the subject, to consider it as the *narcotic principle*, or at least as one species of the substances belonging to this genus.

How obtained.

Opium is obtained from the *papaver album*, or white poppy, a plant which is cultivated in great abundance in India and the East. The poppies are planted in a fertile soil and well watered. After the flowering is over, and the seed capsules have attained nearly their full size, a longitudinal incision is made in them about sun-set, for three or four evenings in succession. From these incisions there flows a milky juice, which soon concretes, and is scraped off the plant and wrought into cakes. In this state it is brought to Europe.

Its properties.

Opium, thus prepared, is a tough brown substance, has a peculiar smell, and a nauseous bitter acrid taste. It is a very compound substance, containing sulphate of lime, sulphate of potash, an oil, a resinous body, an extractive matter, gluten, mucilage, &c. besides the peculiar narcotic principle, to which, probably, it owes its virtues as a narcotic.

When water is digested upon opium, a considerable portion of it is dissolved, the water taking up several of its constituents. When this solution is evaporated to the consistence of a syrup, a gritty precipitate begins to appear, which is considerably increased by diluting the liquid with water. It consists chiefly of three ingredients; namely, resin, oxygenized extractive, and the peculiar narcotic principle, which is crystallized. When alcohol is digested on this precipitate, the resin and narcotic substance are taken up, while the oxygenized extractive remains behind. The narcotic principle falls down in crystals as the solution cools, still however coloured with resin. But it may be obtained tolerably pure by repeated solutions and crystallizations.

Water is incapable of dissolving the whole of opium. What remains behind still contains a considerable portion of narcotic principle. When alcohol is digested on this residuum, it acquires a deep red colour; and deposites, on cooling, crystals of narcotic principle, coloured by resin, which may be purified by repeated crystallizations. The narcotic principle obtained by either of these methods possesses the following properties.

Its colour is white. It crystallizes in rectangular prisms with rhomboidal bases. It has neither taste nor smell.

It is insoluble in cold water, soluble in about 400 parts of boiling water, but precipitates again as the solution cools. The solution in boiling water does not affect vegetable blues.

It is soluble in 24 parts of boiling alcohol and 100 parts of cold alcohol. When water is mixed with the solution, the narcotic principle precipitates in the state of a white powder.

Hot ether dissolves it, but lets it fall on cooling.

When heated in a spoon, it melts like wax. When distilled, it froths and emits white vapours, which condense into a yellow oil. Some water and carbonate of ammonia pass into the receiver; and at last carbonic acid gas, ammonia, and carbureted hydrogen gas, are disengaged. There remains a bulky coal, which yields traces of potash. The oil obtained by this process is viscid, and has a peculiar aromatic smell and acrid taste.

It is very soluble in all acids. Alkalies throw it down from these solutions in the state of a white powder.

Alkalies render it rather more soluble in water. When they are saturated with acids, the narcotic principle falls down in the state of a white powder, which is redissolved by adding an excess of acid.

Volatile oils, while hot, dissolve it; but, on cooling, they let it fall in an oleaginous state at first, but it gradually crystallizes.

When treated with nitric acid, it becomes red and dissolves; much oxalic acid is formed, and a bitter substance remains behind.

When potash is added to the aqueous solution of opium, the narcotic principle is thrown down; but it retains a portion of the potash.

Its solubility in water and alcohol, when immediately extracted from opium, seems to be owing to the presence of *resin* and *extractive matter*, both of which render it soluble.

It possesses the properties of opium in perfection. Dérosne tried it upon several dogs, and found it more powerful than opium. Its bad effects were counteracted by causing the animals to swallow vinegar. This substance is known to be of equal service in counteracting the effects of opium. Dérosne supposes that the efficacy of vinegar may be owing to the readiness with which it dissolves the narcotic principle.

SECT. XIX. *Of Oils.*

Oils.

There are two species of oils; namely, *fixed* and *volatile*; both of which are found abundantly in plants.

Fixed oils.

1. Fixed oil is only found in the seeds of plants, and is almost entirely confined to those which have two cotyledons; as linseed, almonds, beech root, poppy seed, rape seed, &c. Sometimes, though rarely, it is found in the pulp which surrounds the stone of certain fruits. This is the case with the olive, which yields the most abundant and most valuable species of fixed oil. The bicotyledonous seeds, besides oil, contain also a mucilaginous substance; and they have all the character of forming, when bruised in water, a milky liquid, known by the name of *emulsion*.

The following is a list of the plants which yield the fixed oils which usually occur in commerce.

Plants which yield fixed oils.

1. Linum usitatissimum et perenne	Linseed oil
2. Corylus avellana 3. Juglans regia	Nut oil
4. Papapaver somniferum	Poppy oil
5. Cannabis sativa	Hemp oil
6. Sesamum orientale	Oil of Sesamum
7. Olea Europea	Olive oil
8. Amygdalus communis	Almond oil
9. Guilandina Mohringa	Oil of behen
10. Cucurbita pepo et melopepo	Cucumber oil
11. Fagus sylvatica	Beech oil
12. Sinapis nigra et arvensis	Oil of mustard
13. Helianthus annuus et perennis	Oil of sunflower
14. Brassica napus et campestris	Rape seed oil
15. Ricinus communis	Castor oil
16. Nicotiana tabacum et rustica	Tobacco seed oil
17. Prunus domestica	Plum kernel oil
18. Vitis vinifera	Grape seed oil
19. Theobroma cacao	Butter of cacao
20. Laurus nobilis	Laurel oil
21. Arachis hypogæa	Ground nut oil

Volatile oils.

2. Volatile oils are found in every part of plants except the cotyledons of the seeds, where they never occur. The root, the stem, the leaves, the flower, the rind or pulp of the fruit of a variety of plants, are loaded with volatile oils, from which they are extracted by expression or by distillation. The numbers of these oils is so great that it baffles all description. Almost every plant which is distinguished by a peculiar odour contains a volatile oil, to which it is indebted for that odour.

The following Table contains a pretty copious list of plants which yield volatile oils. The part of the plant from which it is extracted, and the English name of the oil, are added in separate columns.

Plants which yield volatile oils.

Plants.	*Parts.*	*Oil of*	*Colour.*
1. Artemisia absynthium	Leaves	Wormwood	Green
2. Acorus calamus	Root	Sweet flag	Yellow
3. Myrtus pimenta	Fruit	Jamaica pep. ‡	Yellow
4. Anethum graveolens	Seeds	Dill	Yellow
5. Angelica archangelica	Root	Angelica	
6. Pimpinella	Seeds	Anise	White
7. Illicium anisatum	Seeds	Stellat. anise	Brown
8. Artemisia vulgaris	Leaves	Mugwort	
9. Citrus aurantium	Rind of the fruit	Bergamotte	Yellow
10. Melaleuca leucadendron	Leaves	Cajeput	Green
11. Eugenia caryophyllata	Capsules	Cloves ‡	Yellow
12. Carum carvi	Seeds	Caraways	Yellow
13. Amomum cardamomum	Seeds	Card. seeds	Yellow
14. Carlina acaulis	Roots		White
15. Scandix chærefolium	Leaves	Chervil	Sulph. yel.
16. Matricaria chamomilla	Petals	Chamomile	Blue
17 Laurus cinnamomum	Bark	Cinnamon ‡	Yellow
18. Citrus medica	Rind of the fruit	Lemons	Yellow
19. Cochlearia officinalis	Leaves	Scurvy grass	Yellow
20. Copaifera officinalis	Extract	Copaiba	White
21. Coriandrum sativum	Seeds	Coriand. seed	White
22. Crocus sativus	Pistils	Saffron ‡	Yellow
23. Piper cubeba	Seeds	Cubeb peb	Yellow
24. Laurus culilaban	Bark	Culilaban	Br. yel.
25. Cuminum cyminum	Seeds	Cummi	Yellow
26. Inula helenium	Roots	Elecampane	White
27. Anethum fæniculum	Seeds	Fennel	White
28. Croton elutheria	Bark	Cascarilla	Yellow
29. Maranta galanga	Roots	Galanga	Yellow
30. Hyssopus officinalis	Leaves	Hyssop	Yellow
31. Juniperus communis	Seeds	Juniper	Green
32. Lavendula spica	Flowers	Lavender	Yellow
33. Laurus nobilis	Berries	Laurel	Brownish
34. Prunus laurocerasus	Leaves	Lauroceras. ‡	
35. Levisticum ligusticum	Roots	Lovage	Yellow
36. Myristica moschata	Seeds	Mace	Yellow
37. Origanum majorana	Leaves	Marjoram	Yellow
38. Pistacia lentiscus	Resin	Mastich	Yellow
39. Matricaria parthenium	Plant	Motherwort	Blue
40. Melissa officinalis	Leaves	Balm	White
41. Mentha crispa	Leaves		White
42. ——— piperitis	Leaves	Peppermint	Yellow
43. Achillea millefolium	Flowers	Millefoil	Blue and green
44. Citrus aurantium	Petals	Neroli	Orange
45. Origanum creticum	Flowers	Spanish hop	Brown
46. Apium petroselinum	Roots	Parsley	Yellow

Plants.	Parts.	Oil of	Colour.
47. Pinus sylvestris et abies	Wood and resin	Turpentine	Colourless
48. Piper nigrum	Seeds	Pepper	Yellow
49. Rosmarinus officinalis	Plant	Rosemary	Colourless
50. Mentha pulegium	Flowers	Pennyroyal	Yellow
51. Genista canariensis	Root	Rhodium	Yellow
52. Rosa centifolia	Petals	Roses	Colourless
53. Ruta graveolens	Leaves	Rue	Yellow
54. Juniperus sabina	Leaves	Savine	Yellow
55. Salvia officinalis	Leaves	Sage	Green
56. Santalum album	Wood	Santalum ‡	Yellow
57. Laurus sassafras	Root	Sassafras	Yellow
58. Satureia hortensis	Leaves	Satureia	Yellow
59. Thymus serpillum	Leaves and flower	Thyme	Yellow
60. Valeriana officinalis	Root	Valerian	Green
61. Kæmpferia rotunda	Root	Zedoary	Greenish blue
62. Amomum Zinziber	Root	Ginger	Yellow
63. Andropogon schœnanthum		Sira	Brown

The oils marked ‡ sink in water. They yield also a fixed oil.

Several of the gum resins, as *myrrh* and *galbanum*, yield likewise an essential oil, and likewise the balsam of *benzoin*, &c.

Sect. XX. *Of Wax.*

Wax.

The upper surface of the leaves of many trees is covered with a varnish, which may be separated and obtained in a state of purity by the following process:

How obtained.

Digest the bruised leaves, first in water and then in alcohol, till every part of them which is soluble in these liquids, be extracted. Then mix the residuum with six times its weight of a solution of pure ammonia, and, after sufficient maceration, decant off the solution, filter it, and drop into it, while it is incessantly stirred, diluted sulphuric acid, till more be added than is sufficient to saturate the alkali. The varnish precipitates in the form of a yellow powder. It should be carefully washed with water, and then melted over a gentle fire.

Its properties.

Mr Tingry first discovered that this varnish possesses all the properties of *bees wax*. Wax, then, is a vegetable product. Several plants contain wax in such abundance as to make it worth while to extract it from them. But let us, in the first place, consider the properties of bees wax, the most common and important species. This substance, as Huber has demonstrated, contrary to the generally received opinion, is prepared by the bees from honey or sugar, the latter yielding the greatest proportion of it.

Wax, when pure, is of a whitish colour; it is destitute of taste, and has scarcely any smell. Bees wax, indeed, has a pretty strong aromatic smell; but this seems chiefly owing to some substance with which it is mixed; for it disappears almost completely by exposing the wax, drawn out into thin ribands, for some time to the atmosphere. By this process, which is called *bleaching*, the yellow colour of the wax disappears, and it becomes very white. Bleached wax is not affected by the air.

The specific gravity of unbleached wax varies from 0.9000 to 0.9650; that of white wax from 0.8203 to 0.9662.

Wax is insoluble in water; nor are its properties altered though kept under that liquid.

When heat is applied to wax it becomes soft; and at the temperature of 142°, if unbleached, or of 155° if bleached, it melts into a colourless transparent fluid, which concretes again, and resumes its former appearance as the temperature diminishes. If the heat be still farther increased, the wax boils and evaporates; and if a red heat be applied to the vapour, it takes fire and burns with a bright flame. It is this property which renders wax so useful for making candles.

Wax is scarcely acted on by alcohol when cold, but boiling alcohol dissolves it.

Ether has but little action on wax while cold; but when assisted by heat, it takes up about one-twentieth of its weight of it, and lets the greatest part precipitate on cooling.

Wax combines readily with fixed oils when assisted by heat, and forms with them a substance of greater or less consistency, according to the quantity of oil. This composition, which is known by the name of *cerate*, is much employed by surgeons.

The volatile oils also dissolve wax when heated. This is well known, at least, to be the case with oil of turpentine. A part of the wax precipitates usually as the solution cools, but of a much softer consistence than usual, and therefore containing oil.

The fixed alkalies combine with it, and form a compound which possesses all the properties of common soap. When boiled with a solution of fixed alkalies in water, the liquid becomes turbid, and after some time the soap separates and swims on the surface. It is precipitated from the alkali by acids in the state of flakes, which are the wax very little altered in its properties.

The acids have but little action on wax; even oxymuriatic acid, which acts so violently on most bodies, produces no other change on it than that of rendering it white. This property which wax possesses, of resisting the action of acids, renders it very useful as a lute to confine acids properly in vessels, or to prevent them from injuring a common cork.

Mr Lavoisier contrived to burn wax in oxygen gas. The quantity of wax consumed was 21.9 grains. The oxygen gas employed in consuming that quantity amounted to 66.55 grains. Consequently, the substances consumed, amounted to 88.45 grains. After the combustion, there were found in the glass vessel 62.58 grains of carbonic acid, and a quantity of water, which was supposed to amount to 25.87 grains. These were the only products.

Composition according to Lavoisier.

From this experiment he concluded, that 100 parts of wax are composed of

82.28	carbon
17.72	hydrogen
100.00	

According to Thenard and Gay-Lussac.

But according to the experiments of Thenard and Gay-Lussac, it is composed of

Carbon	81.784
Hydrogen	12.672
Oxygen	5.544
	100

Myrtle wax.

The myrtle wax of North America is obtained from the *myrica cerifera*. The *myrica cerifera* is a shrub which grows abundantly in Louisiana and other parts of North America. It produces a berry about the size of a pepper corn. A very fertile shrub yields nearly seven pounds. From the observations of Cadet, we learn that the wax forms the outer covering of the berries. The wax thus obtained is of a pale green colour. Its specific gravity is 1.0150. It melts at the temperature of 109°: when strongly heated it burns with a white flame, produces little smoke, and during the combustion emits an agreeable aromatic odour. Water does not act upon it. Alcohol, when hot, dissolves one tenth of its weight, but lets most of it fall again on cooling. Hot ether dissolves about one-fourth of its weight; and when slowly cooled, deposites it in crystalline plates, like spermaceti. The ether acquires a green colour, but the wax becomes nearly white. Oil of turpentine, when assisted by heat, dissolves it sparingly. Alkalies act upon it nearly as on bees wax. The same remark applies to acids. Sulphuric acid, when assisted by heat, dissolves about one-twelfth of its weight, and is converted into a thick dark brown mass.

The Chinese extract a wax from various vegetables, which they manufacture into candles, and of which they form many delicate ornaments which are brought to Europe.

Sect. XXI. *Camphor.*

Camphor.

The substance called *camphor*, though unknown to the Greeks and Romans, seems to have been long known in the East. When it was first brought to Europe does not appear, though it seems to have been introduced by the Arabians.

How obtained.

It comes to Europe chiefly from Japan. It is obtained from the *laurus camphora*, a tree common in the East, by distilling the wood along with water in large iron pots, on which are fitted earthen heads stuffed with straw. The camphor sublimes, and concretes upon the straw in the form of a grey powder. It is afterwards refined in Holland by a second sublimation. The vessels are of glass, and somewhat of the shape of a turnip, with a small mouth above loosely covered with paper. According to Ferber, about one-fourth of pounded chalk is mixed with crude camphor; but others assure us that there is no addition whatever employed.

Its properties.

Camphor thus confined is a white brittle substance, having a peculiar aromatic odour, and a strong hot acrid taste. Its specific gravity is 0.9887.

It is not altered by atmospheric air; but it is so volatile, that if it be exposed during warm weather in an open vessel, it evaporates completely. When sublimed in close vessels it crystallizes in hexagonal plates or pyramids.

It is insoluble in water; but it communicates to that liquid a certain portion of its peculiar odour.

It dissolves readily in alcohol, and is precipitated again by water. According to Neumann, well rectified alcohol dissolves three-fourths of its weight of camphor. By distillation the alcohol passes over first, and leaves the camphor. This property affords an easy method of purifying camphor. Dissolve the camphor in alcohol, distil off the spirit, and melt the camphor into a cake in a glass vessel.

Camphor is soluble also in oils, both fixed and volatile. If the solution be made by means of heat, as it cools part of the camphor precipitates, and assumes the form of plumose or feather-like crystals.

Camphor is not acted on by alkalies, either pure or in the state of carbonates. Pure alkalies, indeed, seem to dissolve a little camphor; but the quantity is too small to be perceptible by any other quality than its odour. Neither is it acted on by any of the neutral salts which have hitherto been tried.

Acids dissolve camphor without effervescence, and in general it may be precipitated unaltered from the recent solution.

When heat is applied to camphor it is volatilized. If the heat be sudden and strong, the camphor melts before it evaporates; and it melts, according to Venturi, at the temperature of 300°; according to Romieu, at 421°. It catches fire very readily, and emits a great deal of flame as it burns, but it leaves no residuum. It is so inflammable that it continues to burn even on the surface of water. When camphor is set on fire in a large glass globe, filled with oxygen gas, and containing a little water, it burns with a very bright flame, and produces a great deal of heat. The inner surface of the glass is soon covered with a black powder, which has all the properties of charcoal; a quantity of carbonic acid gas is evolved; the water in the globe acquires a strong smell, and is impregnated with carbonic acid and camphoric acid.

Different species of camphor.

There are several species of camphor which have been examined by chemists, and which differ considerably from each other in their properties. The most remarkable are *common camphor*, the *camphor of volatile oils*, and the *camphor* obtained by treating *oil of turpentine* with *muriatic acid*.

Common camphor, obtained by distillation from the *laurus camphora*, is the substance which has been described in the preceding part of this Chapter. In Borneo and Sumatra camphor is procured from the *laurus sumatrensis*; but as none of this camphor is brought to Europe, we do not know how far it agrees with common camphor in its properties The *laurus cinnamomum* likewise yields camphor.

The second species of camphor seems to exist in a great variety of plants, and is held in solution by the volatile oils extracted from them. Neumann obtained it from oils of thyme, marjoram, cardomum; Hermann, from oils extracted from various species of mint. Cartheuser obtained it from the roots of the *maranta galanga*, *kæmpferia rotunda*, *amomum zinziber*, *laurus cassia*, and rendered it probable that it is contained in almost all the labiated plants. It has been supposed to exist in these plants combined with volatile oil. Proust has shown how it may be extracted, in considerable quantity, from many volatile oils.

From the observations of Mr John Brown, there is reason to believe that the camphor from oil of thyme differs from common camphor in several respects. It does not appear to form a liquid solution either with nitric or sulphuric acid; nor is it precipitated from nitric acid in powder like common camphor, but in a glutinous mass.

The artificial camphor yielded by oil of turpentine, when saturated with muriatic acid gas, was discovered by Mr Kind, apothecary in Eutin, while employed in making a medicine called the *liquor arthriticus Pottii*. He put a quantity of oil of turpentine into a Woulfe's bottle, and caused a current of muriatic acid gas, separated from common salt by sulphuric acid, to pass through it. The salt used was of the same weight with the oil of turpentine. At first the oil became yellow, then brown, and at last became almost solid, from the formation of a great number of crystals in it, which possessed the properties of camphor.

The proportion of muriatic gas found to answer best, is what can be separated by sulphuric acid and heat from a quantity of common salt equal in weight to the oil of turpentine employed. The camphor produced amounts nearly to one-half of the oil of turpentine.

The camphor thus produced was very white; it had a peculiar odour, in which that of the oil of turpentine could be distinguished. When washed with water it became beautifully white, and gave no longer signs of containing an acid, but still had the smell of oil of turpentine. Water containing some carbonate of potash deprived it of part of this odour, but not the whole. When mixed with its own weight of charcoal powder, wood-ashes, quicklime, or porcelain clay, and sublimed, it was obtained in a state of purity.

Its smell, when pure, resembles that of common camphor, but is not so strong. Its taste also resembles that of camphor. It swims on water, to which it communicates its taste, and burns upon its surface. It dissolves completely in alcohol, and is precipitated by water. Nitric acid, of the specific gravity 1.261, had no action on it, though it readily dissolves common camphor; but concentrated nitric acid dissolves it with the disengagement of nitrous gas; and water does not precipitate it from its solution as it does common camphor. Acetic acid does not dissolve it. When heated it sublimes without decomposition; and when set on fire it burns like camphor.

Sect. XXII. *Of Bird lime.*

Bird-lime.

The vegetable principle to which we give the name of *bird-lime*, was first examined by Vauquelin, who found it possessed of properties different from every other. It was found collected on the epidermis of a plant brought to Europe by Michaud, and called *robinia viscosa* by Cels; constituting a viscid substance, which made the fingers adhere to the young twigs. From the late analysis of *bird-lime* by Bouillon la Grange, it is obvious that it owes its peculiar properties to the presence of an analogous substance, which indeed constitutes the essential part of that composition. Hence the reason why we have given the name of *bird-lime* to the principle itself.

Properties of natural bird-lime.

Natural bird-lime (or that which exudes spontaneously from plants), possesses the following properties:

Its colour is green; it has no sensible taste or smell; is extremely adhesive; softens by the heat of the fingers, and sticks to them with great obstinacy. When heated it melts, swells up, and burns with a considerable flame, leaving a bulky charcoal behind it. It does not dissolve in water; alcohol has but little action on it, especially when cold. By the assistance of heat it dissolves a portion of it; but on cooling, allows the greatest part to precipitate again. When exposed to the air it continues glutinous, never becoming hard and brittle like the resins.

It combines readily with oils. Ether is its true solvent, dissolving it readily without the assistance of heat. The solution is of a deep green colour. The alkalies do not combine with it; the effect of the acids was not tried. These properties are sufficient to distinguish bird-lime from every other vegetable principle.

Artificial bird-lime.

Artificial bird-lime is prepared from different substances in different countries. The berries of the misletoe are said to have been formerly employed. They were pounded, boiled in water, and the hot water poured off. At present bird-lime is usually prepared from the middle bark of the holly. The process followed in England, as described by Geoffroy, is as follows: The bark is boiled in water seven or eight hours, till it becomes soft. It is then laid in quantities in the earth, covered with stones, and left to ferment or rot for a fortnight or three weeks. By this fermentation it changes to a mucilaginous consistency. It is then taken from the pits, pounded in mortars to a paste, and well washed with river water. Bouillon la Grange informs us, that at Nogent le Rotrou bird-lime is made by cutting the middle bark of the holly into small pieces, fermenting them in a cool place for a fortnight, and then boiling them in water, which is afterwards evaporated. At Commerci various other plants are used.

Its colour is greenish, its flavour sour, and its consistence gluey, stringy, and tenacious. Its smell is similar to that of linseed oil. When spread on a glass plate, and exposed to the air and light, it dries, becomes brown, loses its viscidity, and may be reduced to powder; but when water is added to it, the glutinous property returns. It reddens vegetable blues.

When gently heated it melts, and emits an odour like that of animal oils. When heated on red hoat coals, it burns with a lively flame, and gives out a great deal of smoke, leaving a white ash, composed of carbonet of lime, alumina, iron, sulphate, and muriate of potash.

Water has little action on bird-lime. When boiled in water the bird-lime becomes more liquid, but recovers its original properties when the water cools. The water, by this treatment, acquires the property of reddening vegetable blues, and when evaporated leaves a mucilaginous substance, which may be likewise separated by alcohol.

A concentrated solution of potash forms with bird-lime a whitish magma, which becomes brown by evaporation, while ammonia separates. The compound thus formed is less viscid than bird-lime, and in smell and taste resembles soap. In alcohol and water it dissolves almost completely, and possesses properties similar to those of soap.

Weak acids soften bird-lime, and partly dissolve it; strong acids act with more violence. Sulphuric acid renders it black; and when lime is added to the solution, acetic acid and ammonia separate. Nitric acid cold has little effect; but when assisted by heat it dissolves the bird-lime; and the solution, when evaporated, leaves behind it a hard brittle mass. By treating this mass with nitric acid, a new solution may be obtained, which by evaporation yields malic and oxalic acids, and a yellow matter which possesses several of the properties of wax. Cold muriatic acid does not act on bird-lime; hot muriatic acid renders it black.

Alcohol of the specific gravity 0.817 dissolves bird-lime at a boiling heat. On cooling, it lets fall a yellow matter similar to wax. The filtered liquid is bitter, nauseous, and acid. Water precipitates a substance similar to resin.

Sulphuric ether dissolves bird-lime readily, and in great abundance. The solution is greenish. When mixed with water, an oily substance separates, which has some resemblance to linseed oil. When evaporated, a greasy substance is obtained, having a yellow colour and the softness of wax. Oil of turpentine dissolves bird-lime readily.

Sect. XXIII. *Of Resins.*

Resins.

It is at present the opinion of chemists, that *resins* stand in the same relation to the *volatile* oils that *wax* does to the *fixed*. Wax is considered as a fixed oil saturated with oxygen; resins, as volatile oils saturated with the same principle.

Resins often exude spontaneously from trees; they often flow from artificial wounds, and not uncommonly are combined at first with volatile oil, from which they are separated by distillation. The reader can be at no loss to form a notion of what is meant by *resin*, when he is informed that common *rosin* furnishes a very perfect example of a resin, and that it is from this substance that the whole genus derived their name: for rosin is frequently denominated *resin*.

I. Resins may be distinguished by the following properties:

General properties.

They are solid substances, naturally brittle; have a certain degree of transparency, and a colour most commonly inclining to yellow. Their taste is more or less acrid, and not like that of volatile oils; but they have no smell unless they happen to contain some foreign body. They are all heavier than water. They are all non-conductors of electricity; and when excited by friction, their electricity is negative.

Their specific gravity varies considerably.

When exposed to heat, they melt; and if the heat be increased, they take fire, and burn with a strong yellow flame, emitting at the same time a vast quantity of smoke.

They are all insoluble in water whether cold or hot; but when they are melted along with water, or mixed with volatile oil, and then distilled with water, they seem to unite with a portion of that liquid; for they become opake, and lose much of their brittleness. This at least is the case with common rosin.

They are all, with a few exceptions, soluble in alcohol, especially when assisted by heat. The solution is usually transparent; and when the alcohol is evaporated, the resin is obtained unaltered in its properties.

Several of them are soluble in fixed oils, especially in the drying oils. The greater number are soluble in the volatile oils; at least in oil of turpentine, the one commonly employed.

Mr Hatchett first examined the action of fixed alkalies on resins, and ascertained, contrary to the received opinion of chemists, that alkaline leys dissolve them with facility. He reduced a quantity of common rosin to powder, and gradually added it to a boiling lixivium of carbonate of potash; a perfect solution was obtained of a clear yellow colour, which continued after long exposure to the air. The experiment succeeded equally with carbonate of soda, and with solutions of pure potash, or soda. Every other resin was dissolved as well as *rosin*.

These alkaline solutions of resins have the properties of soap, and may be employed as detergents. When mixed with an acid, the resin is separated in flakes, usually of a yellow colour, and not much altered in its nature.

Ammonia acts but imperfectly upon resins, and does not form a complete solution of any of those bodies hitherto tried.

It was the received opinion of chemists, that acids do not act upon resins. Mr Hatchett first ascertained this opinion also to be erroneous, and showed that most of the acids dissolve resins with facility, producing different phenomena according to circumstances.

When sulphuric acid is poured upon any of the resins in powder, it dissolves them in a few minutes. At first the solution is transparent, of a yellowish brown colour, and of the consistency of a viscid oil, and the resin may be precipitated nearly unaltered by the addition of water. If the solution be placed on a sand bath, its colour becomes deeper, sulphurous acid gas is emitted, and it becomes very thick, and of an intense black.

Nitric acid likewise dissolves the resins with facility, but not without changing their nature. Mr Hatchett was first led to examine the action of this acid on resins, by observing that resins are thrown down by acids from their solutions in alkalies in the state of a curdy precipitate; but when nitric acid is added in excess, the whole of the precipitate is re-dissolved in a boiling heat. He poured nitric acid of the specific gravity 1.38, on powdered rosin in a tubulated retort; and by repeated distillation formed a complete solution of a brownish yellow colour. The solution takes place much sooner in an open matrass than in close vessels. The solution continues permanent, though left exposed to the air. It becomes turbid when water is added; but when the mixture is boiled, the whole is re-dissolved.

When the digestion of nitric acid upon a resinous substance is continued long enough, and the quantity of acid is sufficient, the dissolved resin is completely changed; it is not precipitated by water; and by evaporation, a viscid substance of a deep yellow colour is obtained, equally soluble in water and alcohol, and seemingly intermediate between resin and extractive. If the abstraction of nitric acid be repeated, this substance gradually assumes the properties of artificial tannin. Thus it appears that nitric acid gradually alters the nature of resin, producing a suite of changes which terminate in artificial tannin, upon which nitric acid has no action.

Muriatic acid and acetic acid dissolve resin slowly, and it may be precipitated again from them unaltered.

When resins are subjected to destructive distillation, we obtain carbureted hydrogen and carbonic acid gas, a very small portion of acidulous water, and much empyreumatic oil. The charcoal is light and brilliant, and contains no alkali.

Resins of most importance, viz.

II. Having now described the general properties of resinous bodies, it will be proper to take a more particular view of those of them which are of the most importance, that we may ascertain how far each possesses the general characters of resins, and by what peculiarities it is distinguished from the rest. The most distinguished of the resins are the following.

Rosin.

1. *Rosin*.—This substance is obtained from different species of *fir*; as the *pinus abies*, *sylvestris*, *larix*, *balsamea*. It is well known that a resinous juice exudes from the *pinus sylvestris*, or common Scotch fir, which hardens into tears. The same exudation appears in the *pinus abies*, or spruce fir. These tears constitute the substance called *thus*, or common frankincense. When a portion of bark is stripped off these trees, a liquid juice flows out, which gradually hardens. This juice has obtained different names according to the plant from which it comes. The *pinus sylvestris* yields *common turpentine*; the *larix*, *Venice turpentine*; the *balsamea*, *balsam of Canada*, &c. All these juices, which are commonly distinguished by the name of turpentine, are considered as composed of two ingredients; namely, oil of turpentine and rosin.

Composition.

According to the experiments of Thenard and Gay Lussac, it is composed of

Carbon	75.944
Oxygen . . .	13.337
Hydrogen . . .	10.719
	100.000

Mastich.

2. *Mastich*.—This resin is obtained from the *pistacia lentiscus*; a tree which grows in the Levant, particularly in the island of Chios. When transverse incisions are made into this tree, a fluid exudes, which soon concretes into yellowish semitransparent brittle grains. It softens when kept in the mouth, but imparts very little taste. When heated, it melts and exhales a fragrant odour. Its taste is slight, but not unpleasant. In Turkey, great quantities of it are said still to be chewed for sweetening the breath, and strengthening the gums. It is to this use of the resin as a masticatory that it is supposed to owe its name. Mastich does not dissolve completely in alcohol; a soft elastic substance separates during the solution. The nature of this insoluble portion was first

examined by Kind, who found it possessed of all the properties of caoutchouc. These experiments have lately been repeated by Mr Matthews with a similar result. Mr Brande, however, has observed, that when this insoluble substance is dried, it becomes brittle, in which respect it differs from caoutchouc. He has observed also, that by passing a current of oxymuriatic gas through the alcoholic solution of mastich, a tough elastic substance is thrown down, precisely similar to the original insoluble portion.

Sandarach,

3. *Sandarach.*—This resin is obtained from the *juniperus communis*, or common juniper. It exudes spontaneously, and is usually in the state of small round tears of a brown colour, and semitransparent, not unlike mastich, but rather more transparent and brittle. When chewed it does not soften as mastich does, but crumbles to powder. Mr Matthews found it almost completely soluble in eight times its weight of alcohol. The residue was extraneous matter. It does not dissolve in tallow or oil, as common resin does.

Elemi,

4. *Elemi.*—This resin is obtained from the *amyris elemifera*; a tree which grows in Canada and Spanish America. Incisions are made in the bark during dry weather, and the resinous juice which exudes is left to harden in the sun. It comes to this country in long roundish cakes wrapped in flag leaves. It is of a pale yellow colour, semitransparent; at first softish, but it hardens by keeping. Its smell is at first strong and fragrant, but it gradually diminishes.

Tacamahac,

5. *Tacamahac.*—This resin is obtained from the *fagara octandra*, and likewise, it is supposed, from the *populus balsamifera*. It comes from America in large oblong masses wrapt in flag leaves. It is of a light brown colour, very brittle, and easily melted when heated. When pure it has an aromatic smell between that of lavender and musk.

Animé,

6. *Animé.*—This resin is obtained from the *hymenæa courbaril*, or locust tree, which is a native of North America. Animé resembles copal very much in its appearance; but is readily soluble in alcohol, which copal is not: this distinguishes them. It is said to be very frequently employed in making varnishes. Alcohol dissolves it completely.

Ladanum,

7. *Ladanum or labdanum.*—This resin is obtained from the *cystus creticus*, a shrub which grows in Syria and the Grecian Islands. The surface of this shrub is covered with a viscid juice, which, when concreted, forms ladanum. It is collected, while moist, by drawing over it a kind of rake with thongs fixed to it. From these thongs it is afterwards scraped with a knife. It is always mixed with dust and sand, sometimes in great abundance. The best is in dark coloured masses, almost black, and very soft, having a fragrant odour and a bitterish taste. The impurities, even in the best kinds, amount to about one-fourth.

Botany Bay resin,

8. *Botany Bay resin.*—This resin is said to be the produce of the *acarois resinifera*; a tree which grows abundantly in New Holland, especially near Botany Bay. Specimens of it were brought to London about the year 1799, where it was tried as a medicine.

The resin exudes spontaneously from the trunk of the singular tree which yields it, especially if the bark be wounded. It is at first fluid, but becomes gradually solid when dried in the sun. It consists of pieces of various sizes, of a yellow colour, unless when covered with a greenish grey crust. It is firm, yet brittle; and when pounded, does not stick to the mortar nor cake. In the mouth it is easily reduced to powder without sticking to the teeth. It communicates merely a slight sweetish astringent taste. When moderately heated, it melts; on hot coals it burns to a coal, emitting a white smoke, which has a fragrant odour somewhat like storax. When thrown into the fire, it increases the flame like pitch. It communicates to water the flavour of storax, but is insoluble in that liquid. When digested in alcohol, two-thirds dissolve: the remaining third consists of one part of extractive matter, soluble in water, and having an astringent taste; and two parts of woody fibre and other impurities, perfectly tasteless and insoluble. The solution has a brown colour, and exhibits the appearance and the smell of a solution of benzoin. Water throws it down unaltered. When distilled, the products were water and empyreumatic oil, and charcoal; but it gives no traces of any acid, alkali, or salt, not even when distilled with water.

Copal,

9. *Copal.*—This substance, which deserves particular attention from its importance as a varnish, and which at first sight seems to belong to a distinct class from the resins, is obtained, it is said, from the *rhus copallinum*, a tree which is a native of North America; but the best sort of copal is said to come from Spanish America, and to be the produce of different trees. No less than eight species are enumerated by Hernandez.

Copal is a beautiful white resinous substance, with a slight tint of brown. It is sometimes opaque, and sometimes almost perfectly transparent. When heated, it melts like other resins; but it differs from them in not being soluble in alcohol, nor in oil of turpentine without peculiar management. Neither does it dissolve in the fixed oils with the same ease as the other resins. It resembles gum animé a little in appearance; but is easily distinguished by the solubility of this last in alcohol, and by its being brittle between the teeth, whereas animé softens in the mouth. The specific gravity of copal varies, according to Brisson, from 1.045 to 1.139. Mr Hatchett found it soluble in alkalies and nitric acid with the usual phenomena; so that in this respect it agrees with the other resins. The solution of copal in alkalies he found indeed opalescent, but it is nevertheless permanent. It deserves attention, that he found rosin, when dissolved in nitric acid, and then thrown down by an alkali, to acquire a smell resembling that of copal.

When copal is dissolved in any volatile liquid, and spread thin upon wood, metal, paper, &c. so that the volatile menstruum may evaporate, the copal remains perfectly transparent, and forms one of the most beautiful and perfect varnishes that can well be conceived. The varnish thus formed is called *copal varnish*, from the chief ingredients in it. This varnish was first discovered in France, and was long known by the name of *vernis martin*. The method of preparing it is concealed; but different processes for dissolving copal in volatile menstrua have been from time to time made public.

According to the experiments of Thenard and Gay-Lussac, copal is composed of

Carbon	76.811
Oxygen	10.606
Hydrogen	12.583
	100.000

Lac,

10. *Lac.*—This is a substance deposited on different species of trees in the East Indies, by an insect called *chermes lacca*, constituting a kind of comb or nidus. It has been imported into Europe, and extensively used from time immemorial; but it is only of late years that correct information concerning it has been obtained. For what relates to the natural history of the insect, and the mode of forming the lac, we are indebted to Mr

Ker, Mr Saunders, and Dr Roxburgh. Though very often employed in the arts, it was neglected by chemists. Mr Hatchett has lately examined it with his usual address, and ascertained its composition and properties.

There are various kinds of lac distinguished in commerce. *Stick lac* is the substance in its natural state, encrusting small twigs. When broken off and boiled in water, it loses its red colour, and is called *seed lac*. When melted and reduced to the state of thin crust, it is called *shell lac*. Stick lac is of a deep red colour, and yields to water a substance which is used as a red dye. The other two varieties are brown.

Water dissolves the greatest part of the colouring matter of lac, which varies from 15 to ½ per cent. Alcohol dissolves the greatest part of the resin, which constitutes the chief ingredient in the composition of lac. Ether acts more feebly. Sulphuric acid dissolves and gradually chars lac; nitric acid dissolves, and then produces the same changes on it as on other resinous bodies. Muriatic and acetic acids likewise act as solvents. A solution of borax in water readily dissolves lac. The best proportions are 20 grains of borax, 100 grains of lac, and four ounces of water. This solution, mixed with lamp black, constitutes Indian ink, and may indeed be employed for many of the purposes of varnish. The fixed alkalies readily dissolve lac, but not the volatile. When placed on a hot iron it melts, and emits a thick smoke with an odour rather pleasant, leaving a spongy coal. When distilled, it yields water slightly acidulous, and a thick butyraceous oil. The gases emitted are a mixture of carbonic acid and carbureted hydrogen. Stick lack yields also some carbonate of ammonia; but the other two varieties none. The following Table exhibits the constituents of the different varieties of lac, according to the analysis of Mr Hatchett.

	Stick Lac.	Seed Lac.	Shell Lac.
Resin	68	88.5	90.9
Colouring matter	10	2.5	0.5
Wax	6	4.5	4.0
Gluten	5.5	2.0	2.8
Foreign bodies .	6.5		
Loss	4.0	2.5	1.8
	100	100	100

The resin is less brittle than those bodies usually are. The colouring matter possesses the properties of extractive; the wax is analogous to myrtle wax, and the gluten closely resembles the gluten of wheat.

Amber.

11. *Amber.*—This substance is undoubtedly of vegetable origin; and though it differs from resins in some of its properties, yet it agrees with them in so many others, that it may, without impropriety, be referred to them.

Amber is a brittle, light, hard substance, usually nearly transparent; sometimes nearly colourless, but commonly yellow or even deep brown. It has considerable lustre. Its specific gravity is 1.065. It is tasteless, and without smell, except when pounded or heated, when it emits a fragrant odour. When heated it softens; but, as far as is known, cannot be melted without losing some of its weight, and altering its appearance. In a strong heat it burns, leaving a small quantity of ashes, the nature of which has not yet been ascertained. Water has no action on it; but alcohol, by long digestion, dissolves about one eighth of the amber, and forms a coloured solution, which, when concentrated, becomes milky when mixed with water. The residuum of the amber is not acted on by alcohol. Though amber be roasted before the action of the alcohol, the tincture is still formed. Hence we learn that the resinous part of amber is not expelled by a melting heat.

The weaker acids have no action on amber. Sulphuric acid converts it into a black resinous mass. Nitric acid acts upon it; when assisted by heat, nitrous gas is emitted.

Amber varnish.

Neither fixed nor volatile oils have any action on amber unless it has been previously roasted or exposed to a melting heat. When thus treated, it combines with oils, and the solution forms *amber varnish*. The process recommended by Nystrom is this: Amber is to be spread on a flat-bottomed iron pan, and placed on an equal coal fire till it melt; it is then to be withdrawn, covered with a plate of copper and iron, and allowed to cool. If the process be properly conducted, the amber will have lost half of its weight. If the fire be too strong, the amber will be scorched and rendered useless. If it be too low, the amber will not melt, but be reduced to a brown crust, which answers well enough for a varnish, provided it be exposed to heat till it is reduced to one half of the original weight. One part of this roasted amber is to be mixed with three parts of the linseed oil (rendered drying by litharge and white vitriol,) and the mixture exposed to a gentle heat till the amber is dissolved: it is then to be withdrawn from the fire, and when nearly cold, four parts of oil of turpentine are to be added. The whole is then allowed to settle, and the clear portion is passed through a linen cloth.

SECT. XXIV. *Of Guaiacum.*

Guaiacum.

How obtained.

This substance is obtained from the *guaiacum officinale*, a tree which is a native of the West Indies, and yields a very hard heavy wood. The resin exudes spontaneously, and is also driven out artificially, by heating one end of the wood in billets previously bored longitudinally; the melted resin runs out at the extremity farthest from the fire. This substance has been used in medicine for a considerable time, having been originally recommended in venereal diseases. Nothing is known concerning its original introduction into Europe.

It was considered by chemists as a resin, till Mr Hatchett observed, that when treated with nitric acid it yielded products very different from those of the resinous bodies. This induced Mr William Brande to examine its chemical properties in detail.

Its properties.

Guaiacum is a solid substance, resembling a resin in appearance. Its colour differs considerably, being partly brownish, partly reddish, and partly greenish; and it always becomes green when left exposed to the light in the open air. It has a certain degree of transparency, and breaks with a vitreous fracture. When pounded it emits a pleasant balsamic smell, but has scarcely any taste, although when swallowed it excites a burning sensation in the throat. When heated it melts, and diffuses at the same time a pretty strong fragrant odour. Its specific gravity is 1.2289.

When guaiacum is digested in water, a portion of it is dissolved, the water acquiring a greenish brown colour, and a sweetish taste. The liquid, when evaporated, leaves a brown substance, which possesses the property of *extractive*.

Alcohol dissolves guaiacum with facility, and forms a deep brown-coloured solution. Water renders this solution milky by separating the resin. Muriatic acid throws down the guaiacum of an ash-grey, and sulphuric acid of a pale green colour. Acetic acid and the alkalies occasion no precipitate. Liquid oxymuriatic acid throws it down of a fine pale blue, which does not change when dried. Diluted nitric acid occasions no change at first; but after some hours the liquid becomes green, then blue, and at last brown, and at that period a brown-coloured precipitate falls down. If water be mixed with the liquid when it has assumed a green or a blue colour, green and blue precipitates may be respectively obtained.

Sulphuric ether does not act so powerfully on guaiacum as alcohol. The solution obtained by means of it, exhibits the same properties when treated with re-agents as that in alcohol.

The alkaline solutions, both pure and in the state of carbonates, dissolve guaiacum with facility. Two ounces of a saturated solution of potash dissolved about 65 grains of guaiacum; the same quantity of ammonia only 25 grains; or guaiacum dissolves in about 15 parts of potash, and 35 parts of ammonia.

Most of the acids act upon guaiacum with considerable energy.

Sulphuric acid dissolves it, and forms a deep red liquid, which deposites while fresh a lilac-coloured precipitate when mixed with water. When heat is applied, the guaiacum is charred.

Nitric acid dissolves guaiacum completely without the assistance of heat, and with a strong effervescence. When the solution is evaporated, it yields a very large quantity of oxalic acid. No artificial tannin appears to be formed, but rather a substance possessing the properties of extractive. Diluted nitric acid converts guaiacum into a brown substance, similar to the precipitate obtained by nitric acid from the alcoholic solution of guaiacum. This brown matter possesses the properties of a resin.

Muriatic acid acts but slightly, as the guaiacum soon melts into a blackish mass, which is not acted upon.

Composition.

When guaiacum is distilled, 100 parts of it yielded to Mr Brande the following products:

Acidulous water	5.5
Thick brown oil	24.5
Thin empyreumatic oil	30.0
Charcoal	30.5
Gases, consisting of carbonic acid and carbureted hydrogen	9.5
	100.0

The coal when incinerated left three grains of lime, but no alkaline substance.

SECT. XXV. *Of Balsams.*

Balsams.

The term *balsam* or *balm* was originally confined to a thick fragrant juice obtained from the *amyris gileadensis*, and afterwards applied by chemists to all substances which possess the same degree of consistence and a strong smell, whether natural or artificial. Bucquet restricted the term to those resinous-like substances which yield benzoic acid when heated. This new meaning of the word, which has been adopted by chemists in general, has introduced into the class of balsams several substances which were formerly considered as resins. The word *balsam* originally implied a substance possessing a certain degree of fluidity; but now there are two classes of balsams; the one fluid, and the other solid and brittle.

A balsam, then, is a substance which possesses the general properties of a resin; but which, when heated or digested in acids, yields a portion of benzoic acid. Chemists, in general, have considered them as combinations of a resin with benzoic acid; but Mr Hatchett has made it probable, that the acid is formed at the time of its separation.

Their properties.

They are insoluble in water; but when boiled in that liquid often give out a portion of benzoic acid. Alcohol and ether dissolve them readily. The strong acids likewise dissolve them; and during the solution a portion of benzoic acid is separated. Nitric acid, in some cases, evolves likewise traces of prussic acid. The alkalies act upon them nearly as on the resins. They may be divided into two classes; namely, *liquid* and *solid* balsams.

1. *Liquid Balsams.*

Liquid balsams, viz.

The liquid balsams at present known are four in number; namely,

1. Copaiva. 3. Peru.
2. Tolu. 4. Styrax.

Copaiva,

1. *Copaiva.* This balsam is obtained from the *copaifera officinalis*, a tree which grows in South America, and some of the West India Islands. It exudes from incisions made in the trunk of the tree. The juice thus obtained is transparent, of a yellowish colour, an agreeable smell, a pungent taste, at first of the consistence of oil, but it gradually becomes as thick as honey. Its specific gravity is 0.950. When mixed with water and distilled, there comes over with the water a very large quantity of volatile oil. The residuum consists of two substances; namely, the watery portion, and a greyish yellow substance, lying at the bottom of the vessel, which, on exposure to the air, dries, and becomes brittle and transparent. When heated it melts, and possesses the characters of a resin. When distilled it yielded a yellowish thick oil, some acidulous thick water, and a gas, one-sixth of which was carbonic acid, and the remainder seemed to possess the characters of olefiant gas. From these facts, which have been long known, it was concluded, that copaiva is a compound of a resin and a volatile oil, which passes over at a heat inferior to that of boiling water; but the experiments of Schonberg have rendered it much more probable, that the balsam is decomposed when distilled along with water, and that both the oil and resin are new products.

Whether this balsam yields benzoic acid has not been ascertained. Its properties are rather against the probability of its doing so. Indeed it bears a striking resemblance to turpentine in many respects, and ought, along with it, to constitute a class of bodies intermediate between volatile oils and resins, to which the name of *turpentines* might be given.

Balsam of tolu,

2. *Balsam of Tolu.* This substance is obtained from the *toluifera balsamum*, a tree which grows in South America. The balsam flows from incisions made in the bark. It comes to Europe in small gourd shells. It is of a reddish brown colour, and considerable consistence; and when exposed to the air, it becomes solid and brittle. Its smell is fragrant, and continues so even after the balsam has become thick by age. When distilled with water it yields very little volatile oil, but impregnates the water strongly with its taste and smell. A quantity of benzoic acid sublimes, if the distillation be continued.

Balsam of Peru,

3. *Balsam of Peru.* This substance is obtained from the *myroxylon peruiferum*, which grows in the warm parts of South America. The tree is full of resin, and the balsam is obtained by boiling the twigs in water. It has the consistency of honey, a brown colour, an agreeable smell, and a hot acrid taste. When boiled with water for some time, the liquid separated by the filter reddens vegetable blues, and deposits crystals of benzoic acid on cooling. The water contains no other substance. When

distilled with water, it yields a very small quantity of reddish limpid oil.

Styrax.

4. *Styrax.* This is a semifluid juice, said to be obtained from the *liquidambar styraciflua*, a tree which grows in Virginia, Mexico, and some other parts of America. It is prepared, according to Mr Petiver, in the island of Cobross in the Red Sea, from the bark of a tree called *rosa mallos* by the natives, and considered by botanists as the same with the American species. The bark of this tree is boiled in salt water to the consistence of bird-lime, and then put into casks. Its colour is greenish, its taste aromatic, and its smell agreeable. It is easily volatilized by heat. When treated with water, benzoic acid is dissolved. It is totally soluble in alcohol, except the impurities. When exposed to the air, it becomes harder, and absorbs oxygen. When distilled, it yields an acidulous water, having the odour of benzoic acid, a limpid colourless hot oil, a solid coloured oil, benzoic acid, and a mixture of carbonic acid and carbureted hydrogen. The charcoal is light, and contains some oil.

2. *Solid Balsams.*

Solid balsams, viz.

The solid balsams at present known are only three in number; namely,

1. Benzoin.
2. Storax.
3. Dragon's blood.

Benzoin,

1. **Benzoin.** This substance is the produce of the *styrax benzoe*, a tree which grows in Sumatra, &c. Benzoin is obtained from this tree by incision; a tree yielding three or four pounds. It is a solid brittle substance, sometimes in the form of yellowish white tears joined together by a brown substance, and sometimes in the form of a brown substance not unlike common rosin. It has a very agreeable smell, which is increased by heating the benzoin. It has little taste. Its specific gravity is 1.092.

Cold water has very little effect on benzoin, but boiling water takes up a portion of benzoic acid.

Alcohol dissolves it when assisted by a gentle heat, and forms a deep yellow solution inclining to reddish brown. When this solution is diluted with water, the benzoin precipitates in the form of a white powder.

Ether dissolves benzoin with facility, and the solution with re-agents exhibits the same phenomena as the alcoholic.

Nitric acid acts with violence on benzoin, and converts it into an orange-coloured mass. When assisted by heat, the acid dissolves the benzoin, and, as the solution cools, crystals of benzoic acid gradually separate.

Sulphuric acid dissolves benzoin, while benzoic acid sublimes; the solution is at first a deep red. By continuing the digestion, a portion of artificial tannin is formed, and the charcoal evolved amounts to 0.48 of the benzoin dissolved.

Acetic acid dissolves benzoin without the assistance of heat. When heat is applied, the solution, as it cools, becomes turbid, owing to the separation of benzoic acid.

Benzoin is dissolved, by a boiling lixivium of the fixed alkalies; a dark brown solution is formed, which becomes turbid after some days exposure to the air. Ammonia likewise dissolves benzoin sparingly.

When Mr Brande exposed 100 grains of benzoin in a retort to a heat gradually raised to redness, the products were,

Benzoic acid	9.0
Acidulous water	5.5
Butyraceous and empyreumatic oil	60.0
Charcoal	22.0
Carbureted hydrogen and carbonic acid	3.5
	100.0

Storax,

2. *Storax.* This is the most fragrant of all the balsams, and is obtained from the *styrax officinalis*, a tree which grows in the Levant, and it is said also in Italy. Sometimes it is in the state of red tears; and this is said to be the state in which it is obtained from the tree. But common storax is in large cakes; brittle, but soft to the touch, and of a reddish brown colour. This is more fragrant than the other sort, though it contains a considerable mixture of saw-dust. It dissolves in alcohol. When distilled with alcohol or with water, scarcely any oil is obtained. When distilled by the naked fire, it seems, from the experiments of Neumann, to yield the same products as benzoin.

Dragon's blood.

3. *Dragon's blood.* This is a brittle substance of a dark red colour, which comes from the East Indies. There are two sorts of it; one in small oval drops or tears of a fine deep red, which becomes crimson when the tears are reduced to powder; the other is in larger masses, some of which are pale red, and others dark. It is probably obtained from different kinds of trees; the *calamus draco* is said to furnish most of what comes from India. The *dracæna draco* and the *pterocarpus draco* are also said to furnish it.

Dragon's blood is brittle and tasteless, and has no sensible smell. Water does not act upon it, but alcohol dissolves the greatest part, leaving a whitish red substance, partially acted upon by water. The solution has a fine deep red colour, which stains marble, and the stain penetrates the deeper the hotter the marble is. It dissolves also in oils, and gives them a deep red colour. When heated, it melts, catches flame, and emits an acid fume similar to that of benzoic acid. When digested with lime, a portion of it becomes soluble in water, and it acquires a balsamic odour. On adding muriatic acid to the solution, a red resinous substance is precipitated, and slight traces of benzoic acid only become perceptible. Nitric acid acts upon it with energy, changes it to a deep yellow, a portion of benzoic acid is sublimed, and a brown mass remains soluble in water, and possessing the properties of artificial tannin.

SECT. XXVI. *Of Caoutchouc.*

Caoutchouc.

About the beginning of the 18th century, a substance called *caoutchouc* was brought as a curiosity from America. It was soft, wonderfully elastic, and very combustible. The pieces of it that came to Europe were usually in the shape of bottles, birds, &c. This substance is very much used in rubbing out the marks made upon paper by a black lead pencil, and therefore in this country it is often called *Indian rubber*.

How obtained.

It is now known, that there are at least two trees in South America from which caoutchouc may be obtained; the *hævea caoutchouc*, and the *jatropha elastica*; and it is exceedingly probable that it is extracted also from other species of *hævea* and *jatropha*. Several trees likewise which grow in the East Indies yield caoutchouc; the principal of these are, the *ficus indica*, the *artocarpus integrifolia*, and the *urceola elastica*.

When any of these plants are punctured, there exudes from it a milky juice, which, when exposed to the air, gradually lets fall a concrete substance, which is caoutchouc.

If oxymuriatic acid be poured into the milky juice, the caoutchouc precipitates immediately, and at the same time the acid loses its peculiar odour. This renders it probable that the formation of the caoutchouc is owing to its basis absorbing oxygen. If the milky juice be confined in a glass vessel containing common air, it gradually absorbs oxygen, and a pellicle of caoutchouc appears on its surface.

Its properties.

Caoutchouc, when pure, is of a white colour, and without either taste or smell. The blackish colour of the caoutchouc of commerce is owing to the method employed in drying it after it has been spread upon moulds. The usual way is to spread a thin coat of the milky juice upon the mould, and then to dry it by exposing it to smoke; afterwards another coat is spread on, which is dried in the same way. Thus the caoutchouc of commerce consists of numerous layers of pure caoutchouc alternating with as many layers of soot.

Caoutchouc is soft and pliable like leather. It is exceedingly elastic and adhesive, so that it may be forcibly stretched out much beyond its usual length, and instantly recover its former bulk when the force is withdrawn. It cannot be broken without very considerable force. Its specific gravity is 0.9335.

Caoutchouc is not altered by exposure to the air; it is perfectly insoluble in water; but if boiled for some time, its edges become somewhat transparent, owing undoubtedly to the water carrying off the soot; and so soft, that when two of them are pressed and kept together for some time, they adhere as closely as they formed one piece. By this contrivance pieces of caoutchouc may be soldered together, and thus made to assume whatever shape we please.

Caoutchouc is insoluble in alcohol. This property was discovered very early, and fully confirmed by the experiments of Mr Macquer. The alcohol, however, renders it colourless.

Caoutchouc is soluble in ether. This property was first pointed out by Macquer. Berniard, on the contrary, found that caoutchouc was scarcely soluble at all in sulphuric ether, which was the ether used by Macquer, and that even nitric ether was but an imperfect solvent. The difference in the results of these two chemists was very singular; both were remarkable for their accuracy, and both were too well acquainted with the subject to be easily misled. The matter was first cleared up by Mr Cavallo. He found that ether, when newly prepared, seldom or never dissolved caoutchouc completely; but if the precaution was taken to wash the ether previously in water, it afterwards dissolved caoutchouc with facility.

When the ether is evaporated, the caoutchouc is obtained unaltered. Caoutchouc, therefore, dissolved in ether, may be employed to make instruments of different kinds, just as the milky juice of the *hævea*; but this method would be a great deal too expensive for common use.

Caoutchouc is soluble in volatile oils; but, in general, when these oils are evaporated, it remains somewhat glutinous, and therefore is scarcely proper for those uses to which, before its solution, it was so admirably adapted.

The acids act but feebly upon caoutchouc. Sulphuric acid, even after a long digestion, only chars it superficially. When treated with nitric acid, there came over azotic gas, carbonic acid gas, prussic acid gas; and oxalic acid is said to be formed. Muriatic acid does not affect it. The other acids have not been tried.

Fabroni has discovered, that rectified petroleum dissolves it, and leaves it unaltered when evaporated.

When exposed to heat it readily melts; but it never afterwards recovers its properties, but continues always of the consistence of tar. It burns very readily with a bright flame, and diffuses a fetid odour. In those countries where it is produced, it is often used by way of candle.

When distilled, it gives out ammonia. It is evident from this, and from the effect of sulphuric and nitric acid upon it, that it is composed of carbon, hydrogen, azote, and oxygen; but the manner in which they are combined is unknown.

Sect. XXVII. *Of Gum Resins.*

Gum resins.

This class of vegetable substances has been long distinguished by physicians and apothecaries. It contains many active substances much employed in medicine; and they certainly possess a sufficient number of peculiar properties to entitle them to be ranked apart. Unfortunately these substances have not yet attracted much of the attention of chemists. Their properties and constituents, of course, are but imperfectly ascertained.

They are usually opake, or at least their transparency is inferior to that of the resins. They are always solid, and most commonly brittle, and have sometimes a fatty appearance.

When heated, they do not melt as the resins do; neither are they so combustible. Heat, however, commonly softens them, and causes them to swell. They burn with a flame.

They have almost always a strong smell, which in several instances is alliaceous. Their taste also is often acrid, and always much stronger than that of the resins.

They are partially soluble in water; but the solution is always opake, and usually milky.

Alcohol dissolves only a portion of them. The solution is transparent; but when diluted with water it becomes milky; yet no precipitate falls, nor is any thing obtained by filtering the solution.

Vinegar and wine likewise dissolve them partially; and the solution, like the aqueous, is opaque or milky.

According to Hermbstadt, they are insoluble in sulphuric ether.

The action of alkalies on them has been examined only by Mr Hatchett. All of them tried by that celebrated chemist, dissolved readily in alkaline solutions, when assisted by heat. We may therefore consider them as soluble in alkalies like resins.

Nitric acid acts upon them with energy; converting them first into a brittle mass, and then, with the assistance of heat, dissolving them.

Their specific gravity is usually greater than that of the resins.

Their other properties still continue unknown. They all either exude spontaneously from plants, or are obtained by incisions. At first they seem to be in a liquid state; but they gradually harden when exposed to the air and weather.

The gum resins which have been hitherto applied to any useful purpose are the following:—

Galbanum.

1. *Galbanum.* It is obtained from the *bubon galbanum*, a perennial plant, and a native of Africa. When this plant is cut across a little above the root, a milky juice flows out, which soon hardens and constitutes galbanum. It comes to this country from the Levant, in small pieces, composed of tears, agglutinated together, of a yellowish or white colour. Its taste is acrid and bitter, and its smell peculiar. Water, vinegar, and wine, dissolve part of it, but the solution is milky. Alcohol dissolves about three-fifths.

Ammoniac. 2. *Ammoniac.*—This substance is brought from the East Indies. Nothing certain is known concerning the plant which yields it; though from analogy it has been suspected to be a species of *ferula*. It is in small pieces, agglutinated together, and has a yellowish white colour. Its smell is somewhat like that of galbanum, but more pleasant. Its taste is a nauseous sweet, mixed with bitter. It does not melt. Water dissolves a portion of it; the solution is milky, but gradually lets fall a resinous portion. More than one half is soluble in alcohol. This portion is a resin.

According to the analysis of Braconnot, ammonia is composed of the following ingredients:

70.0	resin
18.4	gum
4.4	glutinous matter
6.0	water
1.2	loss
100.0	

Olibanum. 3. *Olibanum.*—This substance is obtained from the *Boswallia thurifera*, and is chiefly collected in India. It is the frankincense of the ancients. It is in transparent brittle masses about the size of a chesnut. Its colour is yellow. It has a bitterish nauseous taste; and when burnt diffuses an agreeable odour. Alcohol dissolves three fourths of it, and water about three-eighths.

Asafœtida. 4. *Asafœtida.*—This substance is obtained from the *ferula asafœtida*, a perennial plant, which is a native of Persia. When the plant is about four years old, its roots are dug up and cleaned. Their extremity being then cut off, a milky juice exudes, which is collected. Then another portion is cut off, and more juice exudes. This is continued till the roots are exhausted. The juice thus collected soon hardens and constitutes *asafœtida*. It comes to Europe in small grains of different colours, whitish, reddish, violet, brown. It is pretty hard, but brittle. Its taste is acrid and bitter; its smell strongly alliaceous and fetid. Alcohol dissolves about three-fourths of this substance; and water takes up nearly one-fourth if applied before the spirit.

Scammony. 5. *Scammony.*—This substance is obtained from the *convolvulus scammonia*, a climbing plant which grows in Syria. The roots, when cut, yield a milky juice. This, when collected and allowed to harden, constitutes scammony. Colour dark grey or black. Smell peculiar and nauseous: taste bitter and acrid. With water it forms a greenish-coloured opaque liquid. Alcohol dissolves the greatest part of it. It is usually mixed with the expressed juice of the root, and frequently also with other impurities, which alter its appearance. In medicine it operates as a strong cathartic.

Opoponax. 6. *Opoponax.*—This substance is obtained from the *pastinaca opoponax*, a plant which is a native of the countries round the Levant. The gum resin, like most others, is obtained by wounding the roots of the plant. The milky juice, when dried in the sun, constitutes the opoponax. It is in lumps of a reddish yellow colour, and white within. Smell peculiar. Taste bitter and acrid. With water it forms a milky solution, and about one-half of it dissolves. Alcohol acts but feebly.

Gamboge. 7. *Gamboge* or *Gumgutt.*—This substance is obtained from the *stalagmitis gambogioides*, a tree which grows wild in the East Indies. In Siam it is obtained in drops by wounding the shoots; in Ceylon it exudes from wounds in the bark. It is brought to Europe in large cakes. Its colour is yellow; it is opaque, brittle, and breaks vitreous. It has no smell, and very little taste. With water it forms a yellow turbid liquid. Alcohol dissolves it almost completely; and when mixed with water becomes turbid, unless the solution contains ammonia.

Braconnot analyzed it, and found it composed of one part of a gum which possessed the properties of cherry tree gum, and four parts of a reddish brittle resin, which possessed the characteristic properties of the resins.

Myrrh. 8. *Myrrh.*—The plant from which this substance is obtained is unknown. According to Bruce, it belongs to the genus of *mimosa*. It grows in Abyssinia and Arabia. It is in the form of tears. Colour reddish yellow; when pure somewhat transparent, but it is often opake. Odour peculiar. Taste bitter and aromatic. Does not melt when heated, and burns with difficulty.

From the analysis of Braconnot it appears that myrrh is composed of about

23	resin
77	gum
100	

The resin is reddish, has a bitter taste, and the peculiar odour of myrrh. The gum differs in its properties from every other gummy substance hitherto examined. It has a dark brown colour; is at first soluble in water, but by boiling the liquid, or by exposing the gum to heat, it requires cohesive properties, and becomes insoluble in water. When distilled it yields ammonia, and when dissolved in nitric acid, azotic gas is disengaged.

It deserves attention, that the gum resins, when subjected to destructive distillation, yield all of them a portion of ammonia; a proof that they all contain azote. In this respect they agree with gum and extractive.

SECT. XXVIII. *Of Cotton.*

Cotton. Cotton is a soft down which envelopes the seeds of various plants, especially the different species of *gossypium*, from which the cotton of commerce is procured. These plants are natives of warm climates; grow wild in Asia, Africa, and America, within the tropics; and are cultivated in the East and West Indies.

Though no correct chemical investigation of the properties of cotton has hitherto been made, yet as its obvious qualities distinguish it sufficiently from every other vegetable substance, we must consider it as a peculiar vegetable principle; and it has been introduced here, in hopes that some person or other will be induced to examine its nature in detail. The following are the particulars at present known.

Properties at present known. This substance is in threads differing in length and fineness. No asperities can be discovered on the surface of these threads; but if Lewenhoeck's microscopical observations are to be trusted, they are all triangular, and have three sharp edges. Cotton differs considerably in colour; but when *bleached* it becomes of a fine white.

Cotton is tasteless and destitute of smell. It is completely insoluble in water, alcohol, ether, and oils, and in all the vegetable acids.

The diluted alkaline leys have no perceptible action on cotton; but when very strong they dissolve it if assisted by a sufficient degree of heat. The new products obtained by this solution have not been examined.

Cotton combines readily with tannin, and forms a yellow or brown compound. Hence the infusion of galls, and other astringent substances, is often used as a mordant for cotton.

Nitric acid decomposes cotton when assisted by heat, and oxalic acid is formed; the other products have not been examined. Sulphuric acid likewise chars it. Oxymuriatic acid gas bleaches it, and probably alters and dissolves it when applied in a concentrated state.

Cotton is extremely combustible, and burns with a clear lively flame. The ashes left behind, according to Neumann, contain some potash. When distilled, it yields a great portion of acidulous water, and a small quantity of oil, but no ammonia.

SECT. XXIX. *Of Suber.*

Suber.

This name has been introduced into chemistry by Fourcroy, to denote the outer bark of the *quercus suber*, or the common cork; a substance which possesses properties different from all other vegetable bodies.

Its properties.

It is exceedingly light, soft, and elastic; very combustible, burning with a bright white flame, and leaving a light black bulky charcoal; and when distilled, it yields a little ammonia.

When digested in water, a yellowish coloured solution is obtained, seemingly containing extractive, as nearly the same proportion is taken up by alcohol. Sulphuric acid readily chars it. Nitric acid gives it a yellow colour, corrodes, dissolves, and decomposes it; converting it partly into suberic acid, partly into a substance resembling wax, partly into artificial tannin, and partly into a kind of starchy matter.

SECT. XXX. *Of Wood.*

Wood.

All trees, and most other plants, contain a particular substance, well known by the name of *wood*. If a piece of wood be well dried, and digested, first in a sufficient quantity of water, and then of alcohol, to extract from it all the substances soluble in these liquids, there remains only behind the *woody fibre*.

Its properties.

This substance, which constitutes the basis of wood, is composed of longitudinal fibres, and is easily subdivided into a number of smaller fibres. It is somewhat transparent; is perfectly tasteless; has no smell; and is not altered by exposure to the atmosphere.

It is insoluble in water and in alcohol. The fixed alkalies, when assisted by heat, give it a deep brown colour, render it soft, and decompose it. A weak alkaline solution dissolves it without alteration; and it may be thrown down again by means of an acid. By this property we are enabled to separate wood from most of the other vegetable principles, as few of them are soluble in weak alkaline leys.

When heated, it blackens without melting or frothing up, and exhales a disagreeable acrid fume, and leaves a charcoal which retains exactly the form of the original mass. When distilled in a retort, it yields an acid liquor of a peculiar taste and smell, distinguished by the name of pyrolignous, and formerly considered as a distinct acid; but Fourcroy and Vauquelin have lately ascertained that it is merely the acetic acid combined with an empyreumatic oil.

Composition of oak.

Thenard and Gay-Lussac found the constituents of oak,

Oxygen, - - -	41.78
Carbon, - - -	52.53
Hydrogen, - - -	5.69
	100

Of beech.

The constituents of beech they found to be

Oxygen, - - -	42.73
Carbon, - - -	51,45
Hydrogen, - - -	5.82
	100

SECT. XXXI. *Of Alkalies.*

Alkalies found in plants.

The only alkalies found in plants are potash and soda. Ammonia may indeed be obtained by distilling many vegetable substances, but it is produced during the operation. One or other of these alkalies is found in every plant which has hitherto been examined. The quantity indeed is usually very small. From the experiments of Vauquelin, it is probable that the alkalies are combined in plants with acetic and carbonic acids.

Potash.

1. Potash is found in almost all plants which grow at a distance from the sea. It may be extracted by burning the vegetable, washing the ashes in water, filtrating the water, and evaporating it to dryness. It is in this manner that all the potash of commerce is procured.

In general, three times as much ashes are obtained from shrubs, and five times as much from herbs, as from trees. Equal weights of the branches of trees produce more ashes than the trunk, and the leaves more than the branches. Herbs arrived at maturity produce more ashes than at any other time. Green vegetables produce more ashes than dry.

Soda.

2. Soda is found in almost all the plants which grow in the sea, and in many of those which grow on the shore. In general, the quantity of soda which plants contain bears a much greater proportion to their weight than the potash does which is found in inland vegetables. 100 parts of the *salsola soda*, for instance, yield 19.921 of ashes; and these contain 1.992 parts of soda; some of which, however, is combined with muriatic acid. The plants from which the greater part of the soda, or *barilha* as it is called, which is imported from Spain, is extracted, are the *salsola sativa* and *vermiculata*.

SECT. XXXII. *Of Earths.*

Earths found in plants.

The only earths hitherto found in plants are the four following: *lime, silica, magnesia, alumina.*

Lime.

1. Lime is usually the most abundant of the earths of plants, and the most generally diffused over the vegetable kingdom. Indeed it is a very uncommon thing to find a plant entirely destitute of lime: salsola soda is almost the only one in which we know for certain that this earth does not exist.

Silica.

2. Silica exists also in many plants, particularly in grasses and equisetums. Mr Davy has ascertained that it forms a part of the epidermis, or outer bark of these plants; and that in some of them almost the whole epidermis is silica.

Magnesia.

3. Magnesia does not exist so generally in the vegetable kingdom as the two preceding earths. It has been found, however, in considerable quantities in several sea plants, especially fuci; but the salsola soda contains a greater proportion of magnesia than any plant hitherto examined. Mr Vauquelin found that 100 parts of it contained 17.929 of that earth.

Alumina.

4. Alumina has only been found in very small quantities in plants.

The following Table exhibits the quantity of earths and metallic oxides in grains, obtained by Schræder from 32 ounces of the seeds of the following kinds of corn; wheat (*triticum hybernum*), rye (*secale cereale*), barley (*hordeum vulgare*), oats (*avena sativa*), and likewise from the same quantity of rye straw.

	Wheat.	Rye.	Barley.	Oats.	Rye Straw.
Silica	13.2	15.6	66.7	144.2	152
Carbonate of lime . .	12.6	13.4	24.8	33.75	46.2
Carbonate of magnesia	13.4	14.2	25.3	33.9	28.2
Alumina	0.6	1.4	4.2	4.5	3.2
Oxide of manganese .	5.0	3.2	6.7	6.95	6.8
Oxide of iron	2.5	0.9	3.8	4.5	2.4
	47.3	48.7	131.5	227.8	328.8

Sect. XXXIII. *Of Metals.*

Metals found in ashes of vegetables.

Several metallic substances have also been found in the ashes of vegetables, but their quantity is exceedingly small; so small, indeed, that without very delicate experiments their presence cannot even be detected.

The metals hitherto discovered are iron, which is by far the most common, manganese, and, if we believe some chemists, gold.

Iron.

1. Iron has been found in many plants; the ashes of salsola contain a considerable quantity of it.

Manganese.

2. Scheele first detected manganese in vegetables. Proust found it in the ashes of the pine, calendula, vine, green oak, and fig-tree.

Gold.

3. With respect to the minute portion of gold extracted from the ashes of plants by Kunkel, Sage, &c. it is probable that it proceeded rather from the lead which they employed in their processes than from the ashes.

Chap. II. *Of Vegetation.* See the articles Botany, and Vegetable *Physiology.*

Chap. III. *Of the Decomposition of Vegetable Substances.* See the articles Bread, Fermentation, Putrefaction, Vinegar, and Wine.

BOOK V.

OF ANIMALS.

Of animals.

When we compare animals and vegetables together, each in their most perfect state, nothing can be easier than to distinguish them. The plant is confined to a particular spot, and exhibits no mark of consciousness or intelligence: the animal, on the contrary, can remove at pleasure from one place to another, is possessed of consciousness, and a high degree of intelligence. But on approaching the contiguous extremities of the animal and vegetable kingdom, these striking differences gradually disappear; the objects acquire a greater degree of resemblance; and at last approach each other so nearly, that it is scarcely possible to decide whether some of those species which are situated on the very boundary, belong to the animal or vegetable kingdom.

To draw a line of distinction, then, between animals and vegetables, would be a very difficult task: but it is not necessary at present to attempt it; for almost the only animals whose bodies have been hitherto examined with any degree of chemical accuracy, belong to the most perfect classes, and consequently are in no danger of being confounded with plants. Indeed, the greater number of facts which we have to relate apply only to the human body, and to those of a few domestic animals. The task of analysing all animal bodies is immense, and must be the work of ages of indefatigable industry.

This part of the subject naturally divides itself into two Chapters. In the first Chapter, we shall give an account of the different ingredients hitherto found in animals, such of them at least as have been examined with any degree of accuracy; and, in the second, we shall treat of the different members of which animal bodies are composed, which must consist each of various combinations of the ingredients described in the first Chapter.

Chap. I.

Of Animal Substances.

Animal substances.

The substances which have been hitherto detected in the animal kingdom, and of which the different parts of animals, as far as these parts have been analysed, are found to be composed, may be arranged under the following heads:

1. Gelatine.	8. Resins.
2. Albumen.	9. Sulphur.
3. Mucus.	10. Phosphorus.
4. Fibrin.	11. Acids.
5. Urea.	12. Alkalies.
6. Saccharine matter.	13. Earths.
7. Oils.	14. Metals.

These shall form the subject of the following Sections.

Sect. I. *Of Gelatine.*

Gelatine.

If a piece of the fresh skin of an animal, an ox for instance, after the hair and every impurity is carefully separated, be washed repeatedly in cold water till the liquid ceases to be coloured, or to abstract any thing; if the skin, thus purified, be put into a quantity of pure water, and boiled for some time, part of it will be dissolved. Let the decoction be slowly evaporated till it is reduced to a small quantity, and then put aside to cool. When cold, it will be found to have assumed a solid form, and to resemble precisely that tremulous substance well known to every body under the name of *jelly.* This is the substance called in chemistry *gelatine.* If the evaporation be still farther continued, by exposing the jelly to dry air, it becomes hard, semitransparent, breaks with a glassy fracture, and is, in short, the substance so much employed in different arts under the name of *glue.* Gelatine, then, is precisely the same with glue; only that it must be supposed always free from those impurities with which glue is so often contaminated.

How obtained.

Its properties.

Gelatine is semitransparent, and colourless when pure. Its consistency and hardness vary considerably. The best kinds are very hard, brittle, and break with a glassy fracture. Its taste is insipid, and it has no smell.

When thrown into water it swells very much, but does not readily dissolve; and when taken out, it is soft and gelatinous; but when allowed to dry, it recovers its former appearance. If it be put in this gelatinous state into warm water, it very soon dissolves, and forms a solution of an opal colour, and the more opake according to the quantity of gelatine which it contains. Tremulous gelatine dissolves in a very small portion of hot water; but as the solution cools, it gelatinizes afresh. If this solution, as soon as it assumes the tremulous form, be mixed with cold water and shaken, a complete solution takes place.

Dry gelatine undergoes no change when kept; but in the gelatinous state, or when dissolved in water, it very soon putrefies; an acid makes its appearance in the first place, (probably the acetic,) a fetid odour is exhaled, and afterwards ammonia is formed.

Acids dissolve gelatine with facility, even when diluted, especially when assisted by heat; but we are still ignorant of the changes produced upon it by these agents, except by nitric acid. When this acid is digested on it, a small quantity of azotic gas is disengaged, then abundance of nitrous gas; the gelatine is dissolved, except an oily matter which appears on the surface, and converted partly into oxalic and malic acids.

Alkalies dissolve gelatine with facility, especially when assisted by heat; but the solution does not possess the properties of soap.

None of the earths seem to combine with gelatine; at least they do not precipitate it from its solution in water.

The metals, in their pure state, have no effect upon gelatine; but several of the metallic oxides, when agitated in a solution of gelatine, have the property of depriving the water of the greatest part of that body, with which they form an insoluble compound. Several of the metallic salts likewise precipitate gelatine from water.

Gelatine is insoluble in alcohol. When alcohol is mixed with a solution of gelatine, the mixture becomes milky; but becomes again transparent when agitated, unless the solution be concentrated, and the quantity of alcohol considerable. Gelatine is most probably equally insoluble in ether; though I believe the experiment has not been tried.

When the solution of tannin is dropt into gelatine, a copious white precipitate appears, which soon forms an elastic adhesive mass not unlike vegetable gluten. This precipitate is composed of gelatine and tannin; it soon dries in the open air, and forms a brittle resinous-like substance, insoluble in water, capable of resisting the greater number of chemical agents, and not susceptible of putrefaction.

Gelatine does not, properly speaking, combine with oils, but it renders them miscible with water, and forms a kind of emulsion.

From the effects of different re-agents on gelatine, and from the decomposition which it undergoes when heated, we see that it contains carbon, hydrogen, azote, and oxygen. The phosphate of lime, and the traces of soda, which it always yields, are most likely only held in solution by it. The constituents, according to the experiments of Thenard and Gay-Lussac, was as follows:

Composition.

Carbon,	67.881
Oxygen,	27.207
Hydrogen,	7.914
Azote,	16.998
	100

Sect. II. *Of Albumen.*

Albumen.

The eggs of fowls contain two very different substances: a yellow oily-like matter, called the *yolk;* and a colourless glossy viscid liquid, distinguished by the name of *white.* This last is the substance which chemists have agreed to denominate *albumen.* The white of an egg, however, is not pure albumen. It contains also some mucus, soda, and sulphur: but as albumen is never found perfectly pure, and as no method is known of separating it, without at the same time altering the properties of the albumen, chemists are obliged to examine it while in combination with these bodies.

Its properties.

Albumen dissolves readily in water, and the solution has the property of giving a green colour to vegetable blues, in consequence of the soda which it contains. When albumen is heated to the temperature of 165°, it *coagulates* into a white solid mass; the consistency of which, when other things are equal, depends, in some measure, on the time during which the heat was applied. The coagulated mass has precisely the same weight that it had while fluid. This property of coagulating when heated is characteristic of albumen, and distinguishes it from other bodies.

The taste of coagulated albumen is quite different from that of liquid albumen: its appearance, too, and its properties, are entirely changed; for it is no longer soluble, as before, either in hot or in cold water.

The coagulation of albumen takes place even though air be completely excluded; and even when air is present, there is no absorption of it, nor does albumen in coagulating change its volume. Acids have the property of coagulating albumen, as Scheele ascertained. Alcohol also produces, in some measure, the same effect. *Heat,* then, *acids* and *alcohol,* are the agents which may be employed to coagulate albumen.

It is remarkable, that if albumen be diluted with a sufficient quantity of water, it can no longer be coagulated by any of these agents.

We see, therefore, that albumen ceases to coagulate whenever its particles are separated from each other beyond a certain distance. That no other change is produced, appears evident from this circumstance, that whenever the watery solution of albumen is sufficiently concentrated by evaporation, coagulation takes place, upon the application of the proper agents, precisely as formerly.

It does not appear that the distance of the particles of albumen is changed by coagulation; for coagulated albumen occupies precisely the same sensible space as liquid albumen.

Albumen, then, is capable of existing in two states; the one before it has been coagulated, and the other after it has undergone coagulation. Its properties are very different in each. It will be proper therefore to consider them separately.

Albumen, in its natural state, or uncoagulated, is a glary liquid, having little taste and no smell. When dried spontaneously, or in a low heat, it becomes a brittle transparent glassy-like substance; which, when spread thin upon surfaces, forms a varnish, and is accordingly employed by bookbinders for that purpose. When thus dried, it has a considerable resemblance to gum arabic, to which also its taste is similar. The white of an egg loses about four-fifths of its weight in drying. It is still soluble in water, and forms the same glary liquid as before.

From the experiments of Dr Bostock, it appears, that when one part of this dry albumen is dissolved in nine parts of water, the solution becomes perfectly solid when coagulated by heat; but if the albumen amounts only to $\frac{1}{11}$th of the liquid, then, though coagulation takes place, the liquid does not become perfectly solid, but may be poured from one vessel to another.

When one grain of albumen is dissolved in 1000 grains of water, the solution becomes cloudy when heated.

Uncoagulated albumen.

I. Uncoagulated albumen soon putrefies, unless it be dried; in which state it does not undergo any change. It putrefies more readily when dissolved in a large quantity of water, than when concentrated. The smell of the white of egg, allowed to run into putrefaction, resembles that of *pus*.

It is insoluble in alcohol and ether, which immediately coagulate it, unless it be mixed with a very great proportion of water; in which case even acids have no effect.

When acids are poured upon it, coagulation takes place equally; but several of them have the property of dissolving it again when assisted by heat. This at least is the case with sulphuric acid. The solution is of a green colour, and does not soon blacken even when boiled. It is the case also with nitric acid, and probably also with muriatic acid. Nitric acid first disengages some azotic gas; then the albumen is gradually dissolved, nitrous gas emitted, oxalic and malic acids formed, and a thick oily matter makes its appearance on the surface.

None of the earths form insoluble compounds with albumen; in this respect they resemble the alkalies. The case is different with the metallic oxides.

Every metal tried, except cobalt, occasions a precipitate; but no precipitate ever appears when the oxide is held in solution by an alkali or earth. The effect of the metallic salts on albumen forms a striking contrast with their effect on gelatine.

From the experiments of Dr Bostock, it appears that a drop of the saturated solution of oxymuriate of mercury, let fall into water containing $\frac{1}{1000}$th part of its weight of albumen, produces an evident milkiness, and a curdy precipitate falls. It is therefore a very delicate test of the presence of albumen in animal fluids.

If a solution of tannin be poured into an aqueous solution of uncoagulated albumen, it forms with it a very copious yellow precipitate of the consistence of pitch, and insoluble in water. This precipitate is a combination of tannin and albumen. When dry it is brittle, like over-tanned leather, and is not susceptible of putrefaction. This property which albumen has of precipitating with tannin was discovered by Seguin.

The infusion of galls is by no means so delicate a test of the presence of albumen as of gelatine. When an infusion of galls, containing 2½ per cent. of solid matter, and water holding $\frac{1}{1000}$th of albumen in solution, are mixed in equal quantities, no effect is produced at first, but after some time a precipitating matter appears, and slowly subsides.

Coagulated albumen.

II. When albumen is coagulated either by heat, alcohol, or acids, it is an opaque substance of a pearl white colour, tough, and of a sweetish mucilaginous taste. It is no longer soluble in water, and is not nearly so susceptible of decomposition as uncoagulated albumen. Mr Hatchett kept it for a month under water, and yet it did not become putrid.

When this substance was digested for some hours in water, it gradually softened, and became white and opake like newly coagulated albumen. When water is made to act upon it long, a small portion of it is taken up. The watery liquid is not precipitated by the infusion of tan; but nitromuriate of tin occasions a faint cloud.

According to Scheele, the mineral acids, when greatly diluted with water, dissolve a portion of coagulated albumen, which is thrown down again by the same acids concentrated.

When coagulated albumen is steeped in diluted nitric acid, the acid in about four weeks begins to acquire a yellow tinge, which becomes gradually deeper; but the albumen, though it becomes more opake, is not dissolved. The yellow acid, when saturated with ammonia, becomes of a deep orange colour, but does not let fall any precipitate. When the albumen, thus treated, is immersed in ammonia, the liquid assumes a deep orange colour, inclining to blood-red. The albumen is slowly dissolved, and the solution has a deep yellowish brown colour. If the albumen, after being steeped in nitric acid, be washed and then boiled in water, it is dissolved, and forms a pale yellow liquid, which gelatinises when properly concentrated. If the gelatinous mass be again dissolved in boiling water, the solution is precipitated by tan and by nitro muriate of tin. Hence we see that nitric acid has the property of converting coagulated albumen into gelatine.

Concentrated nitric acid dissolves coagulated albumen with effervescence, especially when assisted by heat. It becomes orange brown when mixed with ammonia, but no precipitate falls.

It is readily dissolved by boiling lixivium of potash, ammonia is disengaged, and an animal soap is formed. This soap, when dissolved in water, and mixed with acetic or muriatic acids, lets fall a precipitate which is of a saponaceous nature. When heated gently, some oil flows from it, and a brownish viscid substance remains. The alkalies, when diluted, and not assisted by heat, act upon it slowly and imperfectly.

These properties indicate sufficiently that coagulated albumen is a very different substance from uncoagulated albumen.

III. From the effects of nitric acid on albumen; and its products, when subjected to destructive distillation, it has been concluded that it consists of carbon, hydrogen, azote, and oxygen.

Composition.

According to the experiments of Thenard and Gay-Lussac, its constituents are as follows:

Carbon, ...	52.883
Oxygen, ...	23.872
Hydrogen, ...	7.540
Azote, ...	15.705
	100

Mr Hatchett has rendered it very probable that it is the first of the soft part of animals that is formed, and that all the other soft parts are formed from it.

SECT. III. *Of Mucus.*

Mucus.

No word in chemistry has been used with less precision than *mucus*. Too many experimenters have made it serve as a common name for every animal substance which cannot be referred to any other class. Dr Bostock, in his excellent papers on the *Analysis of Animal Fluids*, has endeavoured to fix the meaning of the word, by ascertaining the properties of pure mucus. Fourcroy and Vauquelin have lately written an elaborate paper on the same subject.

How obtained.

From Bostock's experiments it appears, that if the solid matter obtained by evaporating saliva to dryness be re-dissolved in water and filtered, the solution will contain very little except mucus. He obtained mucus, also, by macerating an oyster in water, and evaporating the liquid. Mucus, thus obtained, possesses the following properties:

Its properties.

1. It has much the appearance of gum arabic, excepting that, in general, it is rather more opaque; like it, it has little taste, dissolves readily in water, and forms an adhesive solution.

2. When evaporated to dryness, it is transparent, inelastic, and has much the appearance of gum. It is insoluble in water, but dissolves readily in all the acids, though very much diluted.

3. It does not dissolve in alcohol, nor in ether.

4. It does not coagulate when heated; nor when con-

centrated by evaporation does its solution assume the form of a jelly.

5. It is not precipitated by the oxymuriate of mercury, nor by the infusion of galls.

6. The acetate of lead occasions a copious white precipitate when dropt into solutions containing mucus; the superacetate produces a much less striking effect.

7. Nitrate of silver likewise occasions a precipitate in solutions containing mucus.

8. When heated, it assumes the appearance of horn, and when distilled it yields the common products of animal substances. According to Fourcroy and Vauquelin, horn, nails, hair, feathers, the epidermis, and the scales which form on the skin, consist chiefly of mucus.

Many of the substances called *mucus* have the property of absorbing oxygen, and of becoming by that means insoluble in water. They resemble vegetable extractive matter in this respect.

Sect. IV. *Fibrin.*

Fibrin.

How obtained.

If a quantity of blood, newly drawn from an animal, be allowed to remain at rest for some time, a thick red clot gradually forms in it, and subsides. Separate this clot from the rest of the blood, put it into a linen cloth, and wash it repeatedly in water till it ceases to give out any colour or taste to the liquid; the substance which remains after this process is denominated *fibrin*. It has been long known to physicians under the name of the *fibrous part of the blood*, but has not till lately been accurately described.

It may be procured also from the muscles of animals. Mr Hatchett, to whom we are indebted for a very interesting set of experiments on this substance, cut a quantity of lean beef into small pieces, and macerated it in water for 15 days, changing the water every day, and subjecting the beef to pressure at the same time, in order to squeeze out the water. As the weather was cold, it gave no signs of putrefaction during this process. The shreds of muscle, which amounted to about three pounds, were now boiled for five hours every day, for three weeks, in six quarts of fresh water, which was regularly changed every day. The fibrous part was now pressed, and dried by the heat of a water bath. After this treatment it might be considered as fibrin nearly as pure as it can be obtained.

Its properties.

Fibrin is of a white colour, has no taste nor smell, and is not soluble in water nor in alcohol. When newly extracted from blood, it is soft and elastic, and resembles very much the gluten of vegetables. Its colour deepens very much in drying. That which is extracted from muscle by boiling and maceration has a certain degree of transparency, and is not ductile but brittle. Its colour does not deepen nearly so much as the fibrin from blood.

It undergoes no change though kept exposed to the action of air; neither does it alter speedily though kept covered with water. Mr Hatchett kept a quantity of the fibrin which he had prepared from beef moistened with water during the whole month of April; it acquired a musty but not a putrid smell, neither were the fibres reduced to a pulpy mass. Even when kept two months under water, it neither became putrid, nor was converted into the fatty matter obtained by macerating recent muscle.

When fibrin is exposed to heat, it contracts very suddenly, and moves like a bit of horn, exhaling at the same time the smell of burning feathers. In a stronger heat it melts. When exposed to destructive distillation, it yields water, carbonate of ammonia, a thick heavy fetid oil, traces of acetic acid, carbonic acid, and carbureted hydrogen gas.

Acids dissolve fibrin with considerable facility. Sulphuric acid gives it a deep brown colour; charcoal is precipitated, and acetic acid formed. Muriatic acid dissolves it, and forms with it a green-coloured jelly. The acetic, citric, oxalic, and tartaric acids also dissolve it by the assistance of heat; and the solutions, when concentrated, assume the appearance of jelly. Alkalies precipitate the fibrin from acids in flakes, soluble in hot water, and resembling gelatine in its properties.

Diluted nitric acid occasions the separation of a good deal of azotic gas, as was first observed by Berthollet. Mr Hatchett steeped a quantity of fibrin in nitric acid diluted with thrice its weight of water for 15 days. The acid acquired a yellow tinge, and possessed all the properties of the nitric solution of albumen. The fibrin thus treated, dissolved in boiling water, and when concentrated by evaporation, became a gelatinous mass, soluble in hot water, and precipitated by tan and nitromuriate of tin, and therefore possessing the properties of gelatine. Ammonia dissolves the greater part of the fibrin after it has been altered by nitric acid. The solution is of a deep orange colour, similar to the solution of albumen treated in the same way. Boiling nitric acid dissolves fibrin, except some fatty matter which swims on the surface. The solution resembles that of albumen; except that ammonia throws down a white precipitate, consisting chiefly of oxalate of lime. During the solution, prussic acid comes over, and carbonic acid gas mixed with nitrous gas; a considerable portion of oxalic acid is formed besides the fatty matter which swims.

The alkalies, while diluted, have but little effect upon fibrin; but when concentrated potash, or soda is boiled upon it, a complete solution is obtained of a deep brown colour possessing the properties of soap. During the solution ammonia is disengaged. When the solution is saturated with muriatic acid, a precipitate is obtained similar to that from animal soap, except that it sooner becomes hard and soapy when exposed to the air.

The earths, as far as is known, have little or no action on fibrin. Neither has the action of the metallic oxides and salts been examined.

Fibrin is insoluble in alcohol, ether, and oils. The effect of other re-agents on it has not been examined.

From the properties above detailed, fibrin appears to be composed of the same constituents as gelatine and albumen; but it contains more carbon and azote, and less oxygen. According to the experiments of Thenard and Gay-Lussac, its constituents are as follows:

Composition.

Carbon	53.360
Oxygen	19.681
Hydrogen	7.021
Azote	19.934
	100

The close resemblance which it bears to albumen, is very obvious from the experiments of Hatchett, just detailed. Nitric acid converts both into *gelatine*, and alkalies convert both into a species of *oil*. Now, as all the soft parts of animals consist of combinations of these three genera, it follows, as Mr Hatchett has observed, that all the soft parts of animals may be either converted into gelatine or animal soap, both substances of the highest importance.

Fibrin exists only in the blood and the muscles of animals; but it is a genus which includes as many species as there are varieties in the muscles of animals; and the great diversity of these substances is well known. The muscles of fish, of fowl, and of quadrupeds, bear scarcely any resemblance to each other.

Sect. V. *Of Urea.*

Urea.

Urea may be obtained by the following process: Evaporate by a gentle heat a quantity of human urine, voided six or eight hours after a meal, till it be reduced to the consistence of a thick syrup. In this state, when put by to cool, it concretes into a crystalline mass. Pour at different times upon this mass four times its weight of alcohol, and apply a gentle heat; a great part of the mass will be dissolved, and there will remain only a number of saline substances. Pour the alcohol solution into a retort, and distil by the heat of a sand bath, till the liquid, after boiling some time, is reduced to the consistence of a thick syrup. The whole of the alcohol is now separated, and what remains in the retort crystallizes as it cools. These crystals consist of the substance known by the name of *urea*.

How obtained.

Its properties.

Urea, obtained in this manner, has the form of crystalline plates crossing each other in different directions. Its colour is yellowish-white: it has a fetid smell, somewhat resembling that of garlic or arsenic; its taste is strong and acrid, resembling that of ammoniacal salts; it is very viscid and difficult to cut, and has a good deal of resemblance to honey. When exposed to the open air, it very soon attracts moisture, and is converted into a thick brown liquid. It is extremely soluble in water; and during its solution a considerable degree of cold is produced. Alcohol dissolves it with facility, but scarcely in so large a proportion as water. The alcohol solution yields crystals much more readily on evaporation than the solution in water.

When nitric acid is dropt into a concentrated solution of urea in water, a great number of bright pearl-coloured crystals are deposited, composed of urea and nitric acid. No other acid produces this singular effect. The concentrated solution of urea in water is brown, but it becomes yellow when diluted with a large quantity of water. The infusion of nutgalls gives it a yellowish-brown colour, but causes no precipitate; neither does the infusion of tan produce any precipitate.

When heat is applied to urea, it very soon melts, swells up, and evaporates with an insupportably fetid odour. When distilled, there comes over first benzoic acid, then carbonate of ammonia in crystals, some carbureted hydrogen gas, with traces of prussic acid and oil; and there remains behind a large residuum, composed of charcoal, muriate of ammonia, and muriate of soda. The distillation is accompanied with an almost insupportably fetid alliaceous odour.

When the solution of urea in water is kept in a boiling heat, and new water is added as it evaporates, the urea is gradually decomposed, a very great quantity of carbonate of ammonia is disengaged, and at the same time acetic acid is formed, and some charcoal precipitates.

When a solution of urea in water is left to itself for some time, it is gradually decomposed. A froth collects on its surface; air bubbles are emitted, which have a strong disagreeable smell, in which ammonia and acetic acid are distinguishable. The liquid contains a quantity of acetic acid. The decomposition is much more rapid if a little gelatine be added to the solution. In that case more ammonia is disengaged, and the proportion of acetic acid is not so great.

When the solution of urea is mixed with one-fourth of its weight of diluted sulphuric acid, no effervescence takes place; but, on the application of heat, a quantity of oil appears on the surface, which concretes upon cooling; the liquid which comes over into the receiver contains acetic acid, and a quantity of sulphate of ammonia remains in the retort dissolved in the undistilled mass. By repeated distillations, the whole of the urea is converted into acetic acid and ammonia.

When nitric acid is poured upon crystallized urea, a violent effervescence takes place, the mixture froths, assumes the form of a dark red liquid, great quantities of nitrous gas, azotic gas, and carbonic acid gas, are disengaged. When the effervescence is over, there remains only a concrete white matter, with some drops of reddish liquid. When heat is applied to this residuum, it detonates like nitrate of ammonia.

Muriatic acid dissolves urea, but does not alter it. Oxymuriatic acid gas is absorbed very rapidly by a diluted solution of urea; small whitish flakes appear, which soon become brown, and adhere to the sides of the vessel like a concrete oil. After a considerable quantity of oxymuriatic acid had been absorbed, the solution, left to itself, continued to effervesce exceeding slowly, and to emit carbonic acid and azotic gas. After this effervescence was over, the liquid contained muriate and carbonate of ammonia.

Urea is dissolved very rapidly by a solution of potash or soda, and at the same time a quantity of ammonia is disengaged; the same substance is disengaged when urea is treated with barytes, lime, or even magnesia. Hence it is evident, that this appearance must be ascribed to the muriate of ammonia, with which it is constantly mixed. When pure solid potash is triturated with urea, heat is produced, a great quantity of ammonia is disengaged; the mixture becomes brown, and a substance is deposited, having the appearance of an empyreumatic oil. One part of urea and two of potash, dissolved in four times its weight of water, when distilled, give out a great quantity of ammoniacal water; the residuum contains acetate and carbonate of potash.

When muriate of soda is dissolved in a solution of urea in water, it is obtained by evaporation, not in cubic crystals, its usual form, but in rectangular octahedrons. Muriate of ammonia, on the contrary, which crystallizes naturally in octahedrons, is converted into cubes, by dissolving and crystallizing it in the solution of urea.

Sect. VI. *Of Saccharine Matter.*

Saccharine matter in animal substances.

Sugar has never been found in animals in every respect similar to the sugar of vegetables; but there are certain animal substances which have so many properties in common with sugar, that they can scarcely be arranged under any other name. These substances are,

1. Sugar of milk.
2. Honey.
3. Sugar of diabetic urine.

Sugar of milk.

1. Sugar of milk may be obtained by the following process: Let fresh whey be evaporated to the consistence of honey, and then allowed to cool; it concretes into a solid mass. Dissolve this mass in water, clarify it with the white of eggs, filter and evaporate to the consistence of a syrup; it deposites, on cooling, a number of brilliant white cubic crystals, which are *sugar of milk*.

When pure, it has a white colour, a sweetish taste, and no smell. Its crystals are semitransparent regular parallelopipeds, terminated by four-sided pyramids. Its specific gravity, at the temperature of 55°, is 1.543. At that temperature it is soluble in seven times its weight of water; but is perfectly insoluble in alcohol. When burnt, it emits the odour of caromel, and exhibits precisely the appearance of burning sugar. When distilled, it yields the same products as sugar, only the empyreumatic oil obtained has the odour of benzoic acid. When treated with nitric acid, it yield *saclactic* acid. From these experiments, it appears that sugar of milk is specifically different from every kind of vegetable sugar at present known. Its constituents, according to the experiments of Thenard and Gay-Lussac, are as follows:

Oxygen	53.834
Carbon	38.825
Hydrogen	7.341
	100

Honey.

2. Honey is prepared by bees, and perhaps rather belongs to the vegetable than the animal kingdom. It has a white or yellowish colour, a soft and grained consistence, a saccharine and aromatic smell. By distillation it affords an acid phlegm and an oil, and its coal is light and spongy like that of the mucilages of plants. Nitric acid extracts from it oxalic acid, precisely as it does from sugar. It is very soluble in water, with which it forms a syrup, and like sugar passes to the vinous fermentation.

According to Proust, there are two kinds of honey; one always liquid, and the other solid and not deliquescent. They may be separated, he says, by means of alcohol.

Sugar of diabetic urine.

3. The urine of persons labouring under the disease known to physicians by the name of *diabetes*, yields, when evaporated, a considerable quantity of matter which possesses properties analogous to sugar. This seems to have been first observed by Willis. When treated with nitric acid, it yielded the same proportion of oxalic acid as an equal quantity of common sugar would have done, making allowance for the saline substances present. No saclactic acid was formed. Hence it follows, that this substance is not analogous to sugar of milk, but nearer common sugar in its properties. It has been supposed incapable of crystallizing regularly like common sugar. But we have seen it prepared by Dr Wollaston in small grains, having almost exactly the appearance of common white sugar.

SECT. VII. *Of Oils.*

Oils.

The oily substances found in animals belong all to the class of fixed oils. They differ very much in their consistence, being found in every intermediate state, from spermaceti, which is perfectly solid, to train oil, which is completely liquid. The most important of them are the following:

Spermaceti.

1. *Spermaceti.*—This peculiar oily substance is found in the cranium of the *physeter macrocephalus*, or spermaceti whale. It is obtained also from some other species. At first it is mixed with some liquid oil, which is separated by means of a woollen bag. The last portions are removed by an alkaline ley, and the spermaceti is afterwards purified by fusion. Thus obtained, it is a beautiful white substance, usually in small scales, very brittle, has scarcely any taste, and but little smell. It is distinguished from all other fatty bodies by the crystalline appearance which it always assumes. It melts, according to the experiments of Bostock, at the temperature of 112°. When sufficiently heated, it may be distilled over without much alteration; but when distilled repeatedly, it loses its solid form, and becomes a liquid oil.

Fat.

2. *Fat.*—This substance is found abundantly in different parts of animals. When pure, it possesses the properties of the fixed oils. Its consistence varies from *tallow* or *suet*, which is brittle, to *hog's lard*, which is soft and semi-fluid. To obtain fat pure, it is cut in small pieces, well washed in water, and the membranous parts and vessels separated. It is then melted in a shallow vessel along with some water, and kept melted till the water is completely evaporated. Thus purified, it is white, tasteless, and nearly insipid.

Train oil.

3. *Train oil.*—This liquid is extracted from the blubber of the whale, and from other fish. It forms a very important article of commerce, being employed for combustion in lamps, and for other purposes. It is at first thick; but, on standing, a white mucilaginous matter is deposited, and the oil becomes transparent. It is then of a reddish brown colour, and has a disagreeable smell.

Animal oil of Dippel.

4. Though all the oily bodies found in animal substances belong to the class of fixed oils, yet there is a peculiar volatile oil which makes its appearance, and which is doubtless formed during the distillation of different animal bodies. Though this oil has now lost that celebrity which drew the attention of the older chemists to it, yet, as its properties are peculiar, a short account of it will not be improper. It it usually called the *animal oil of Dippel*, because that chemist first drew the attention of chemists to it. It is usually obtained from the gelatinous and albuminous parts of animals. The horns are said to answer best. The product of the first distillation is to be mixed with water, and distilled with a moderate heat; the oil which is first obtained is the animal oil of Dippel.

It is colourless and transparent; its smell is strong and rather aromatic; it is almost as light and as volatile as ether; water dissolves a portion of it; and it changes syrup of violets green, owing, as is supposed, to its containing a little ammonia. The acids all dissolve it, and form with it a kind of imperfect soap. Nitrous acid sets it on fire. It forms with alkalies a soap. Alcohol, ether, and oils, unite with it. When exposed to the air it becomes brown, and loses its transparency. It was formerly used as a specific in fevers.

SECT. VIII. *Of Animal Resins.*

Animal resins, viz.

Substances resembling resins are found in different animal bodies, and which, for that reason, may be called *animal resins*. Their properties are somewhat different from the vegetable resins, but they have not been all examined with precision. The following are the most remarkable of these substances.

Resin of bile.

1. *Resin of bile.* This substance may be obtained by the following process: Into thirty-two parts of fresh ox bile pour one part of concentrated muriatic acid. After the mixture has stood for some hours, pass it through a filter, in order to separate a white coagulated substance. Pour the filtrated liquor, which has a fine green colour, into a glass vessel, and evaporate it by a moderate heat. When it has arrived at a certain degree of concentration, a green-coloured substance precipitates. Decant off the clear liquid, and wash the precipitate in a small quantity of pure water. This precipitate is the *basis of bile*, or the *resin of bile*, as it is sometimes called.

The resin of bile is of a dark brown colour; but when spread out upon paper or on wood it is a fine grass green. Its taste is intensely bitter.

When heated to about 122° it melts; and if the heat be still farther increased, it takes fire and burns with rapidity. It is insoluble in water, but soluble in alcohol; and water precipitates it from that liquid.

It is soluble also in alkalies, and forms with them a compound, which has been compared to a soap. Acids, when sufficiently diluted, precipitate it both from water and alkalies without any change; but if they be concentrated, the precipitate is re-dissolved.

Ambergris.

2. *Ambergris.* This substance is found floating on the sea, near the coasts of India, Africa, and Brazil, usually in small pieces, but sometimes in masses of fifty or one hundred pounds weight. Various opinions have been entertained concerning its origin. Some affirmed that it was the concrete juice of a tree; others thought it a bitumen; but it is now considered as pretty well established, that it is a concretion formed in the stomach or intestines of the *physeter macrocephalus*, or spermaceti whale. See AMBERGRIS.

Ambergris when pure, is a light soft substance which swims on water. Its specific gravity varies from 0.78 to 0.92, according to Brissen. Bouillon La Grange, who has lately published an analysis of it, found its specific gravity from 0.849 to 0.844. Its colour is ash grey, with brownish-yellow and white streaks. It has an agreeable smell, which improves by keeping. Its taste is insipid.

According to Bouillon La Grange, it is composed of

52.7	adipocire.
30.8	resin.
11.1	benzoic acid.
5.4	charcoal.
100.0	

Castor.

3. *Castor.* This substance is obtained from the beaver. In each of the inguinal regions of that animal there are two bags, a large and a small. The large one contains the true castor; the small one a substance which has some resemblance to it, but which is in much less estimation. We are indebted to Bouillon La Grange for a set of experiments on it.

Castor is of a yellow colour, and when newly taken from the animal it is nearly fluid. But by exposure to the atmosphere it gradually hardens, becomes darker coloured, and assumes a resinous appearance. Its taste is bitter and acrid, and its odour strong and aromatic.

From the analysis of Bouillon La Grange, we learn that castor contains the following ingredients:

1. Carbonate of potash.
2. Carbonate of lime.
3. Carbonate of ammonia.
4. Iron.
5. Resin.
6. A mucilaginous extractive matter.
7. A volatile oil.

The properties of the resin are analogous to those of the resin of bile.

SECT. IX. *Of Acids.*

Acids found in animals, viz.

The acids which have been discovered ready formed, and constituting a part of animal bodies, are the following:

1. Phosphoric.
2. Sulphuric.
3. Muriatic.
4. Carbonic.
5. Benzoic.
6. Uric.
7. Rosacic.
8. Amniotic.
9. Oxalic.
10. Formic.
11. Acetic.
12. Malic.

Phosphoric,

1. The phosphoric acid is by far the most abundant of all the acids found in animals. Combined with lime, it constitutes the basis of bone; and the phosphate of lime is found in the muscles, and almost all the solid parts of animals; neither are there many of the fluids from which it is absent. In the blood, phosphoric acid is found combined with oxide of iron; and in the urine it exists in excess, holding phosphate of lime in solution.

Sulphuric,

2. Sulphuric acid can scarcely be considered as a component part of any of the substances belonging to the human body. It is said, indeed, to occur sometimes in urine combined with soda. It is, however, a very common constituent of the liquid contents of the inferior animals. Thus sulphate of soda is found in the liquor of the amnios of cows, and sulphate of lime occurs usually in the urine of quadrupeds.

Muriatic,

3. Muriatic acid occurs in most of the fluid animal substances, and is almost always combined with soda, constituting common salt.

Carbonic,

4. Carbonic acid has been detected in fresh human urine by Proust, and it occurs in the urine of horses and cows abundantly, partly combined with lime.

Benzoic,

5. Benzoic acid was first discovered in human urine by Scheele; and Fourcroy and Vauquelin have found it abundantly in the urine of cows. Proust has detected it in the blood, the albumen of an egg, in glue, silk, and wool, in the sponge, different species of algæ, and even in mushrooms.

Uric,

6. Uric or lithic acid was discovered by Scheele in 1776. It is the most common constituent of urinary calculi, and exists also in human urine. That species of calculus which resembles wood in its colour and appearance, is composed entirely of this substance. It was called at first lithic acid; but this name, in consequence of the remarks made by Dr Pearson on its impropriety, has been laid aside, and that of *uric* acid substituted in its place.

Rosacic,

7. Rosacic. During intermittent fevers, urine deposites a very copious precipitate, which has been long known to physicians under the name of *lateritious sediment.* This sediment always makes its appearance at the crisis of fevers. In gouty people, the same sediment appears in equal abundance towards the end of a paroxysm of the disease; and if this sediment suddenly disappears after it has begun to be deposited, a fresh attack may be expected. Scheele considered this sediment as uric acid mixed with some phosphate of lime; and the same opinion has been entertained by other chemists; but Proust affirms, that it consists chiefly of a different substance, to which he has given the name of *rosacic* acid from its colour, mixed with a certain proportion of uric acid and phosphate of lime. This rosacic acid, he informs us, is distinguished from the uric by the facility with which it dissolves in hot water, the violet precipitate which it occasions in muriate of gold, and by the little tendency which it has to crystallize. The experiments of Proust have lately been confirmed by those of Vauquelin.

Amniotic,

8. Amniotic acid has been lately discovered by Vauquelin and Buniva in the liquor of the amnios of the cow, and may be obtained in white crystals, by evaporating that liquid slowly. Hence they have given it the name of *amniotic acid.* It is of a white and brilliant colour; its taste has a very slight degree of sourness; it reddens the tincture of turnsole; it is scarcely soluble in cold water, but very readily in hot water, from which it separates in long needles as the solution cools. It is soluble also in alcohol, especially when assisted by heat.

Oxalic,

9. Oxalic acid has hitherto been found only in a few urinary calculi by Vauquelin and Fourcroy.

Formic. 10. Formic acid has been hitherto found only in the *formica rufa*, or red ant.

Acetic. 11. Acetic. This acid has been detected in urine by Proust. It exists also in the *formica rufa*, or red ant, as has been demonstrated by the experiments of Fourcroy and Vauquelin. It appears also, from the labours of these philosophers and of Thenard, that the acid found in milk is the acetic, disguised a little by holding some salts in solution.

Malic. 12. Malic acid. This acid has been lately detected by Fourcroy and Vauquelin, in the acid liquid obtained from the *formica rufa*. When this liquid is saturated with lime, if acetate of lead be dropt into the solution, a copious precipitate falls, which is soluble in acetic acid. Fourcroy and Vauquelin exposed the precipitate to the proper trials, and ascertained that it was malate of lead.

SECT. X. *Of Alkalies, Earths, and Metals.*

Alkalies found in animals. I. All the alkalies have been found in the fluids of animals.

Potash, 1. Potash is rather uncommon in the human fluids; but it has been detected in the milk of cows, and it has been found abundantly in the urine of quadrupeds.

Soda, 2. Soda exists in all the fluids, and seems always to be combined with albumen. Phosphate and muriate of soda are also found. It is this alkali which gives animal fluids the property of tinging vegetable blues green.

Ammonia. 3. Ammonia has been detected by Proust in urine; and it is formed in abundance during the putrefaction of most animal bodies.

Earths found in animals. II. The only earths hitherto found in animals are lime, magnesia, and silica.

Lime, 1. Lime exists in great abundance in all the larger animals. Combined with phosphoric acid, it constitutes the basis of bones, while shells are composed of carbonate of lime. Phosphate of lime is found also in the muscles and other solid parts, and it is held in solution by almost all the fluids.

Magnesia, 2. Magnesia has been detected in human urine by Fourcroy and Vauquelin, combined with phosphoric acid and ammonia. It constitutes also sometimes a component part of the urinary calculi.

Silica. 3. Silica has not hitherto been detected in any of the component parts of animals, except hair; but Fourcroy and Vauquelin found it in urinary calculi.

Metals found in animals. III. The metals found in animals are two; namely, iron and manganese.

Iron, 1. Iron combined with phosphoric acid is a constituent part of the blood. Its presence was first ascertained by Menghini, who proved at the same time that it does not exist in the solid parts of animals. It is said to exist also in bile.

Manganese. 2. Manganese has been found in human hair, but scarcely in any other animal substance.

CHAP. II.

Parts of Animals.

Parts of animals. THE different substances which compose the bodies of animals may be arranged under the following heads:

1. Bones and shells.
2. Horns and nails.
3. Muscles.
4. Skin.
5. Membranes.
6. Tendons and ligaments.
7. Glands.
8. Brain and nerves.
9. Marrow.
10. Hair and feathers.
11. Silk and similar bodies.

Besides these substances, which constitute the solid parts of the bodies of animals, there are a number of fluids, the most important of which is the *blood*, which pervades every part of the system in all the larger animals. The rest are known by the name of *secretions*, because they are formed, or *secreted* as the anatomists term it, from the blood. The principal animal secretions are the following:

1. Milk.
2. Eggs.
3. Saliva.
4. Pancreatic juice.
5. Bile.
6. Cerumen.
7. Tears.
8. Liquor of the pericardium.
9. Humours of the eye.
10. Mucus of the nose, &c.
11. Sinovia.
12. Semen.
13. Liquor of the amnios.
14. Poisonous secretions.
15. Air.

Various substances are separated either from the blood or the food, on purpose to be afterwards thrown out of the body as useless or hurtful. These are called *excretions*. The most important of them are,

1. Sweat.
2. Urine.
3. Fæces.

Besides the liquids which are secreted for the different purposes of healthy animals, there are others which make their appearance only during disease, and which may therefore be called *morbid secretions*. The most important of these are the following:

1. Pus.
2. The liquor of dropsy.
3. The liquor of blisters.

To these we must add several solid bodies, which are occasionally formed in different cavities, in consequence of the diseased action of the parts. They may be called *morbid concretions*. The most remarkable of them are the following:

1. Salivary calculi.
2. Concretions in the lungs, liver, brain, &c.
3. Intestinal calculi.
4. Biliary calculi.
5. Urinary calculi.
6. Gouty calculi.

These different substances shall form the subjects of the following Sections:

SECT. I. *Of Bones, Shells, and Crusts.*

Bones. By *bones* are meant those hard, solid, well-known substances, to which the firmness, shape, and strength of animal bodies are owing; which, in the larger animals, form, as it were, the ground-work upon which all the rest is built. In man, in quadrupeds, and many other animals, the bones are situated below the other parts, and scarcely any of them are exposed to view; but shell-fish and snails have a hard covering on the outside of their bodies, evidently intended for defence. As these coverings, though known by the name of *shells*, are undoubtedly of a bony matter, we shall include them in this Section.

1. *Bones.*

Their properties. The bones are the most solid parts of animals. Their texture is sometimes dense, at other times cellular and porous, according to the situation of the bone. They are white, of a lamellar structure, and not flexible nor softened by heat. Their specific gravity differs in different parts. That of adults' teeth is 2.2727; the specific gravity of children's teeth is 2.0833.

The component parts of bones are chiefly four; namely, the earthy salts, fat, gelatine, and cartilage.

1. The earthy salts may be obtained either by calcining the bone to whiteness, or by steeping it for a sufficient length of time in acids. In the first case, the salts remain in the state of a brittle white substance; in the second they are dissolved, and may be thrown down by the proper precipitants. These earthy salts are four in number: 1. Phosphate of lime, which constitutes by far the greatest part of the whole. 2. Carbonate of lime. 3. Phosphate of magnesia, lately discovered by Fourcroy and Vauquelin. It occurs in the bones of all the inferior animals examined by these indefatigable chemists, but could not be detected in human bones. 4. Sulphate of lime, detected by Mr Hatchett in a very minute proportion.

2. The proportion of fat contained in bones is various. By breaking bones in small pieces, and boiling them for some time in water, Mr Proust obtained their fat swimming on the surface of the liquid. It weighed, he says, one-fourth of the weight of the bones employed. This proportion appears excessive, and can scarcely be accounted for, without supposing that the fat still retained water.

3. The gelatine is separated by the same means as the fat, by breaking the bones in pieces and boiling them long enough in water. The water dissolves the gelatine, and gelatinizes when sufficiently concentrated. Hence the importance of bones in making portable soups, the basis of which is concrete gelatine, and likewise in making glue. By this process, Proust obtained from powdered bones about one-sixteenth of their weight of gelatine.

4. When bones are deprived of their gelatine by boiling them in water, and of their earthy salts by steeping them in diluted acids, there remains a soft white elastic substance, possessing the figure of the bones, and known by the name of *cartilage*. From the experiments of Hatchett, it appears that this substance has the properties of coagulated albumen. Like that substance, it becomes brittle and semitransparent when dried, is readily soluble in hot nitric acid, is converted into gelatine by the action of diluted nitric acid; for it is soluble in hot water, and gelatinises on cooling, and ammonia dissolves it and assumes a deep orange colour.

Composition.

Ox bones, according to the analysis of Fourcroy and Vauquelin, are composed of

51.0	solid gelatine.
37.7	phosphate of lime.
10.0	carbonate of lime.
1.3	phosphate of magnesia.
100.0	

From the calcined bones of horses and sheep, fowls, and fishes, they extracted about one-thirtysixth part of phosphate of magnesia. More lately, these eminent chemists detected the same constituents in human bones.

The only bone hitherto observed altogether destitute of cartilage is the enamel of the teeth. When the raspings of bones are steeped in diluted acids, the cartilage alone remains undissolved. Now, when the raspings of enamel are treated in this manner, Mr Hatchett observed, that the whole was dissolved without any residuum whatever. If we believe Fourcroy and Vauquelin, the enamel of teeth is composed of

72.9	phosphate of lime.
27.1	gelatine and water.
100.0	

But the most complete analysis of teeth has been made by Mr Pepys, and his results agree exactly with those of Hatchett. He found the enamel of the teeth composed of

78	phosphate of lime.
6	carbonate of lime.
16	loss and water.
100	

2. *Shells.*

Shells.

Under the name of *shells* we include all the bony coverings of the different species of shell fish. Egg shells, also, from the similarity of their texture, belong to the same head. For almost all the knowledge of these substances that we possess, we are indebted to the late important dissertations of Mr Hatchett. A few detached facts, indeed, had been observed by other chemists; but his experiments gave us a systematic view of the constituents of the whole class.

Shells, like bones, consist of calcareous salts united to a soft animal matter; but in them the lime is united chiefly to carbonic acid, whereas in bones it is united to phosphoric acid. In shells, the predominating ingredient is carbonate of lime; whereas in bones, it is phosphate of lime. This constitutes the characteristic difference in their composition.

Mr Hatchett has divided shells into two classes. The first are usually of a compact texture, resemble porcelain, and have an enamelled surface, often finely variegated. The shells belonging to this class have been distinguished by the name of *porcelaneous shells*. To this class belong the various species of *voluta*, *cypræa*, &c. The shells belonging to the second class are usually covered with a strong epidermis, below which lies the shell in layers, and composed entirely of the substance well known by the name of *mother-of-pearl*. They have been distinguished by the name of *mother-of-pearl shells*. The *shell* of the *fresh water muscle*, the *haliotis iris*, the *turbo olearius*, are examples of such shells. The shells of the first of these classes contain a very small portion of soft animal matter; those of the second contain a very large portion. Hence we see that they are extremely different in their composition.

Porcelaneous shells.

1. Porcelaneous shells, when exposed to a red heat, crackle and lose the colour of their enamelled surface. They emit no smoke or smell; their figure continues unaltered, their colour becomes opake white, tinged partially with pale grey. They dissolve when fresh with effervescence in acids, and without leaving any residue; but if they have been burnt, there remains always a little charcoal. The solution is transparent, gives no precipitate with ammonia or acetate of lead; of course it contains no sensible portion of phosphate or sulphate of lime. Carbonate of ammonia throws down an abundant precipitate of carbonate of lime. Porcelaneous shells, then, consist of carbonate of lime cemented together by a small portion of an animal matter, which is soluble in acids, and therefore resembles gelatine.

Mother-of-pearl shells.

2. Mother-of-pearl shells, when exposed to a red heat, crackle, blacken, and emit a strong fetid odour. They exfoliate, and become partly dark grey, partly a fine white. When immersed in acids they effervesce at first strongly; but gradually more and more feebly, till at last the emission of air-bubbles is scarcely perceptible. The acids take up only lime, and leave a number of thin membranous substances, which still retain the form of the shell. From Mr Hatchett's experiments we learn, that these membranes have the properties of coagulated

albumen. Mother-of-pearl shells, then, are composed of alternate layers of coagulated albumen, and carbonate of lime, beginning with the epidermis, and ending with the last formed membrane.

Pearl.

Pearl, a well known globular concretion which is formed in some of these shells, resembles them exactly in its structure and composition. It is a beautiful substance, of a bluish white colour, iridescent, and brilliant. It is composed of concentric and alternate coats of thin membrane and carbonate of lime. Their iridescence is obviously the consequence of the lamellated structure.

3. *Crusts.*

Crusts.

By crusts we understand those bony coverings of which the whole external surface of crabs, lobsters, and other similar sea animals are composed. Mr Hatchett found them composed of three ingredients: 1. A cartilaginous substance, possessing the properties of coagulated albumen; 2. Carbonate of lime; 3. Phosphate of lime. By the presence of this last substance they are essentially distinguished from shells; and by the great excess of carbonate of lime above the phosphate, they are equally distinguished from bones. Thus the crusts lie intermediate between bones and shells, partaking of the properties and constitution of each. The shells of the eggs of fowls must be referred likewise to the class of crusts, since they contain both phosphate and carbonate of lime. The animal cement in them, however, is much smaller in quantity. From the experiments of Berniard and Hatchett, it is extremely probable that the shells of snails are composed likewise of the same ingredients, phosphate of lime having been detected in them by these chemists.

SECT. II. *Of Horns, Nails, and Scales.*

In the last Section we treated of those hard parts of animals which were inflexible and incapable of being softened by heat, and which contained a great portion of calcareous salts; but there is another set of hard parts which possess considerable elasticity, which are softened by heat, and which contain but a very small portion of calcareous matter. This set comprehends the substances well known under the names of *horn*, *nails*, and *scales*.

Horns.

1. *Horns* are well known substances that are attached to the foreheads of oxen, sheep, and various other animals. They are not very hard, as they may be easily cut with a knife or rasped with a file; but they are so tough, as not to be capable of being pounded in a mortar. When in thin plates, they have a degree of transparency, and have been sometimes substituted for glass in windows. When heated sufficiently they become very soft and flexible, so that their shape may be altered considerably. Hence they may be gradually squeezed into a mould, and wrought into various forms, as is well known. When strongly heated in a Papin's digester, they are said to be converted into a gelatinous mass, which possesses the properties of gelatine.

The quantity of earthy matter which they contain is exceedingly small. Mr Hatchett burnt 500 grains of ox horn. The residuum was only 1.5 grain, and not the half of this was phosphate of lime. Seventy-eight grains of the horn of the chamois left only 0.5 of residue, of which less than the half was phosphate of lime. They consist chiefly of a membranous substance, which possess the properties of coagulated albumen; and probably they contain also a little gelatine.

Nails.

2. The *nails*, which cover the extremities of the fingers, are attached to the epidermis, and come off along with it. Mr Hatchett has ascertained that they are composed chiefly of a membranous substance, which possesses the properties of coagulated albumen. They seem to contain also a little phosphate of lime. Water softens, but does not dissolve them; but they are readily dissolved and decomposed by concentrated acids and alkalies. Hence it appears that nails agree with horn in their nature and composition. Under the head of nails must be comprehended the talons and claws of the inferior animals, and likewise their hoofs, which differ in no respect from horn.

Scales.

3. *Scales* of animals are of two kinds; some, as those of serpents and other amphibious animals, have a striking resemblance to horn; while those of fish bear a greater resemblance to mother-of-pearl. The composition of these two kinds of shells is very different.

The scales of fish are composed of different membranous laminæ. When immersed for four or five hours in nitric acid, they become transparent, and perfectly membranaceous. The acid, when saturated with ammonia, gives a copious precipitate of phosphate of lime. Hence they are composed of alternate layers of membrane and phosphate of lime. To this structure they owe their brilliancy. Mr Hatchett found the spicula of the shark's skin to be similar in its composition, but the skin itself yielded no phosphate of lime.

The horny scales of serpents, on the other hand, are composed alone of a horny membrane, and are destitute of phosphate of lime. They yielded, when boiled, but slight traces of gelatine; the horn-like crusts which cover certain insects and other animals, appear, from Mr Hatchett's experiments, to be nearly similar in their composition and nature.

SECT. III. *Of the Muscles of Animals.*

Muscles of animals.

After the hard parts of animals have been examined, it remains for us to consider the composition of the *soft* parts. Of these, the muscles naturally claim our attention in the first place, as being the most important.

The muscular parts of animals are known, in common language, by the name of *flesh*. They constitute a considerable portion of the food of man.

Muscular flesh is composed of a great number of fibres or threads, commonly of a reddish or whitish colour; but its appearance is too well known to require any description. Hitherto it has not been subjected to any accurate chemical analysis.

When a muscle is cut in small pieces, and well washed with water, the blood and other liquids contained in it are separated, and part of the muscular substance also is dissolved. The muscle, by this process, is converted into a white fibrous substance, still retaining the form of the original body. The water assumes the colour which results from mixing water with some blood. When heated it coagulates; brown flakes swim on the surface, consisting of albumen combined with the colouring matter of the blood: some fibrin likewise precipitates. If the evaporation be continued, more albumen precipitates, and at last the whole assumes the form of a jelly. When evaporated to dryness, and treated with alcohol, the gelatine thus formed, together with a little phosphate of soda and of ammonia, remains undissolved; but the alcohol dissolves a peculiar *extractive* matter, first observed by Thouvenel. This matter may be obtained by evaporating the alcohol to dryness. It has a reddish brown colour, a strong acrid taste, and aromatic odour.

If the muscle, after being thus treated with cold water, be boiled for a sufficient time in water, an additional portion of the same substances is separated from it. Some albumen collects on the surface in the form of scum, accompanied with some melted fat. The water, when sufficiently concentrated by evaporation, assumes the form of a jelly. When evaporated to dryness, and treated with alcohol, the gelatine and phosphoric salts remain, while the extractive matter of Thouvenel is dissolved, and may be obtained by evaporating to dryness.

The muscle, thus treated with water, is left in the state of grey fibres, insoluble in water, and becoming brittle when dry. This substance possesses all the properties of *fibrin*.

From these facts, ascertained by Thouvenel and Fourcroy, it appears that the muscles are composed chiefly of fibrin, to which they owe their fibrous structure and their form, and that they contain also,

1. Albumen.
2. Gelatine.
3. Extractive.
4. Phosphate of soda.
5. Phosphate of ammonia.
6. Phosph. of lime and carb. of do.

For the discovery of the last ingredients we are indebted to Mr Hatchett, who found that 500 parts of beef muscle left, after combustion, a residuum of 25.6 parts, consisting chiefly of these salts.

The muscles of different animals differ exceedingly from each other in their appearance and properties, at least as articles of food; but we know little of their chemical differences. The observations of Thouvenel alone were directed to that object, and they are imperfect. The flesh of the *ox* contains, according to him, the greatest quantity of insoluble matter, and leaves the greatest residuum when dried; the flesh of the *calf* is more aqueous and mucous: the land and water *turtle* yields more matter to water than the muscle of the ox; but Thouvenel ascribes the difference to foreign bodies, as ligaments, &c. mixed with the muscle of the turtle: *snails* yield to water a quantity of matter intermediate between that given by beef and veal; with them the muscles of *frogs, cray fish*, and *vipers*, agree nearly in this respect; but the muscles of fresh water fish, notwithstanding their softness, yield a considerably smaller proportion.

SECT. IV. *Of the Skin.*

Skin. The skin is that strong thick covering which envelopes the whole external surface of animals. It is composed chiefly of two parts: a thin white elastic layer on the outside, which is called *epidermis* or *cuticle;* and a much thicker layer, composed of a great many fibres closely interwoven, and disposed in different directions; this is called the *cutis*, or *true skin*. The *epidermis* is that part of the skin which is raised in blisters.

Epidermis. 1. The epidermis is easily separated from the cutis by maceration in hot water. It possesses a very great degree of elasticity.

It is totally insoluble in water and in alcohol. Pure fixed alkalies dissolve it completely, as does lime likewise, though slowly. Sulphuric and muriatic acids do not dissolve, at least they leave no sensible action on it for a considerable time; but nitric acid soon deprives it of its elasticity, and causes it to fall to pieces.

If the cuticle be tinged with nitric acid, the application of ammonia to it is well known to give it instantaneously a deep orange colour. Now, as Hatchett has shown that this change is also produced upon coagulated albumen in the same circumstances, and as the epidermis resembles that substance in all the properties above detailed, it can scarcely be doubted that it is any thing else than a peculiar modification of coagulated albumen.

Cutis. 2. The cutis is a thick dense membrane, composed of fibres interwoven like the texture of a hat. When it is macerated for some hours in water, and agitation and pressure are employed to accelerate the effect, the blood, and all the extraneous matter with which it was loaded, are separated from it, but its texture remains unaltered. On evaporating the water employed, a small quantity of gelatine may be obtained. No subsequent maceration in cold water has any farther effect. When distilled, it yields the same products as fibrin. The concentrated alkalies dissolve it, converting it into oil and ammonia. Weak acids soften it, render it transparent, and at last dissolve it. Nitric acid converts it into oxalic acid and fat, while, at the same time, azotic gas and prussic acid are emitted. When heated it contracts, and then swells, exhales a fetid odour, and leaves a dense charcoal, difficult to incinerate. By spontaneous decomposition in water or moist earth, it is converted into a fatty matter and into ammonia, which compose a kind of soap. When allowed to remain long in water, it softens and putrefies, being converted into a kind of jelly. When long boiled in water it becomes gelatinous, and dissolves completely, constituting a viscid liquor, which, by proper evaporation, is converted into glue. Hence the cutis of animals is commonly employed in the manufacture of glue.

From these facts, the cutis appears to be a peculiar modification of gelatine, enabled to resist the action of water, partly by the compactness of its texture, and partly by the viscidity of the gelatine of which it is formed; for those skins which dissolve most readily in boiling water afford the worst glue. Mr Hatchett has observed that the viscidity of the gelatine obtained from skins is nearly inversely as their flexibility, the supplest hides always yielding the weakest glue; but this glue is very soon obtained from them by hot water. The skin of the eel is very flexible, and affords very readily a great proportion of gelatine. The skin of the shark also readily yields abundance of gelatine; and the same remark applies to the skins of the hare, rabbit, calf, and ox; the difficulty of obtaining the glue and its goodness always increasing with the toughness of the hide. The hide of the rhinoceros, which is exceedingly strong and tough, far surpasses the rest in the difficulty of solution, and in the goodness of its glue. When skins are boiled, they gradually swell and assume the appearance of horn: then they dissolve slowly.

Rete mucosum. 3. As to the *rete mucosum*, or the mucous substance, situated between the cutis vera and epidermis, its composition cannot be determined with precision, because its quantity is too small to admit of examination. It is known that the black colour of negroes depends upon a black pigment, situated in this substance. Oxymuriatic acid deprives it of its black colour, and renders it yellow. A negro, by keeping his feet for some time in water impregnated with that acid, deprived it of its colour, and rendered it nearly white; but in a few days the black colour returned again with its former intensity. This experiment was first made by Dr Beddoes on the fingers of a negro.

SECT. V. *Of Membranes, Tendons, Ligaments, and Glands.*

These substances have not hitherto been subjected to a rigid chemical analysis. But from the properties which have been observed, they appear to have a closer resemblance to the skin than to any other animal substance.

Membranes.

1. The membranes are thin semitransparent bodies, which envelope certain parts of the body, especially the viscera; such as, the dura and pia mater, the plura, the peritoneum, the periosteum, &c. These substances are soft and pliable; when macerated in water, they swell, and become somewhat pulpy; and by continued decoction in hot water they are almost completely dissolved, and the solution concretes into gelatine. They are convertible, of course, into the same substance as the cutis by decoction; hence we must consider their composition as similar. Like hides, they may also be tanned and converted into leather. From the experiments of Mr Hatchett, it appears that they contain no phosphate of lime as a constituent part, and scarcely any saline ingredients; for when calcined, they leave but a very inconsiderable residuum. Thus 250 grains of hog's bladder left only 0.02 grain of residuum.

Tendons.

2. The tendons are strong, pearl-coloured, brilliant bodies, which terminate the muscles, and attach them to the bones, and are known in common language by the name of *sinews*. When boiled, they assume the form of a semitransparent gelatinous substance, of a pleasant taste, well known in boiled meat. If the decoction be continued, they dissolve completely, and are converted into gelatine. From these facts we are authorised to conclude, that the composition of the tendons is similar to that of the membranes and cutis.

Ligaments.

3. The ligaments are strong bands which bind the bones together at the different joints: they are fibrous substances, very dense and strong, and somewhat elastic. When boiled, they yield a portion of gelatine, but they resist the action of water with great obstinacy, and after a great deal of boiling retain their form, and even their strength. The ligaments, then, differ essentially from the two last species. How far they resemble coagulated albumen, remains to be ascertained. It is not unlikely that they will form a genus apart.

Glands.

4. The glands are a set of bodies employed to form or to alter the different liquids which are employed for different purposes in the animal body. There are two sets of them: the *conglobate*, which are small, scattered in the course of the lymphatics; and the *conglomerate*, such as the liver, kidneys, &c. Fourcroy supposes the first of these to be composed of gelatine; but this is not very probable. The structure of the large glands has been examined by anatomists with great care; but we are still ignorant of their composition. Indeed, the present state of chemistry scarcely admits of an accurate analysis of these complicated bodies.

SECT. VI. *Of the Brain and Nerves.*

Brain and nerves.

The brain and nerves are the instruments of sensation, and even of motion; for an animal loses the power of moving a part the instant that the nerves which enter it are cut.

The brain and nerves have a strong resemblance to each other; and it is probable that they agree also in their composition. But hitherto no attempt has been made to analyze the nerves. The only chemists who have examined the nature of *brain* are Mr Thouret and Mr Fourcroy.

The brain consists of two substances, which differ from each other somewhat in colour, but which, in other respects, seem to be of the same nature. The outermost matter, having some small resemblance in colour to wood-ashes, has been called the *cineritious* part; the innermost has been called the *medullary* part.

Properties of brain.

Brain has a soft feel, not unlike that of soap; its texture appears to be very close; its specific gravity is greater than that of water.

When brain is triturated in a mortar with diluted sulphuric acid, part is dissolved; the rest may be separated by filtration in the form of a coagulum. The acid liquor is colourless. By evaporation, the liquid becomes black, sulphurous acid is exhaled, and crystals appear; and when evaporated to dryness, a black mass remains behind. When this mass is diluted with water, a quantity of charcoal separates, and the water remains clear: The brain is completely decomposed, a quantity of ammonia combines with the acid, and forms sulphate of ammonia, while charcoal is precipitated. The water, by evaporation and treatment with alcohol, yields sulphates of ammonia and lime, phosphoric acid, and phosphates of soda and ammonia. Brain, therefore, contains

Phosphate of lime,
Phosphate of soda,
Phosphate of ammonia.

Traces also of sulphate of lime can be discovered in it. The quantity of these salts is very small; altogether they do not amount to $\frac{1}{100}$th part.

Diluted nitric acid, when triturated with brain, likewise dissolves a part, and coagulates the rest. The solution is transparent. When evaporated till the acid becomes concentrated, carbonic acid gas and nitrous gas are disengaged; an effervescence takes places, white fumes appear, an immense quantity of ammonia is disengaged, a bulky charcoal remains, mixed with a considerable quantity of oxalic acid.

When brain is gradually evaporated to dryness by the heat of a water bath, a portion of transparent liquid separates at first from the rest, and the residuum, when nearly dry, acquires a brown colour; its weight amounts to about one-fourth of the fresh brain. It may still be formed into an emulsion with water, but very soon separates again spontaneously.

When alcohol is repeatedly boiled upon this dried residuum, till it ceases to have any more action, it dissolves about five-eighths of the whole. When this alcohol cools, it deposites a yellowish white substance, composed of brilliant plates. When kneaded together by the fingers, it assumes the appearance of a ductile paste: at the temperature of boiling water it becomes soft, and when the heat is increased it blackens, exhales empyreumatic and ammoniacal fumes, and leaves behind it a charry matter. When the alcohol is evaporated, it deposites a yellowish black matter, which reddens paper tinged with turnsole, and readily diffuses itself through water.

Pure concentrated potash dissolves brain, disengaging a great quantity of ammonia.

SECT. VII. *Marrow.*

Marrow.

The hollows of the long bones are in living animals filled with a peculiar species of fat matter, to which the name of *marrow* has been given. In some bones this matter is a good deal mixed with blood, and has a red colour; in others, as the thigh bones, it is purer, and has a yellow colour. Various experiments on this matter were made by the older chemists, showing it to be analogous to animal fats, and pointing out some of its peculiarities. Berzelius has lately examined it in detail, and published the results of his experiments. The marrow on which his trials were made was obtained from the thigh bone of an ox.

Its properties.

Marrow, freed from its impurities, has a white colour with a shade of blue; its taste is insipid and rather sweetish. It softens by the heat of the hand, and melts when heated to 113°. When cooled slowly, it crystallizes in sphericles like olive oil. It burns with a flame like tallow. When distilled it gives first a transparent fluid yellowish oil, accompanied by carbonic acid gas, water, and heavy inflammable air. Afterwards there comes over a white solid oil, accompanied by a less copious evolution of gaseous bodies, and which does not become dark coloured, as happens when tallow is distilled. This had already been observed by Neumann. This solid oil has a disagreeable smell, amounts to 0.8 of the marrow distilled, reddens vegetable blues, and when boiled in water gives out a portion of sebacic acid, which Berzelius considers as benzoic acid.

The empyreumatic oil combines readily with alkalies and their carbonates. With the latter it forms a snow white soap, insoluble in water, though it increases in bulk when placed in contact with that liquid. It combines also with the earths, and forms soaps likewise insoluble in water.

The water which comes over during the distillation of marrow is colourless, has a fetid and sour smell, and an empyreumatic taste. It contains a little acetic acid, empyreumatic oil, and probably benzoic acid; but exhibits no traces of ammonia.

The gaseous products amount to one-tenth of the marrow distilled. They contain no sulphur nor phosphorus, and consist of carbonic acid and heavy inflammable air, which burns with a white flame, and seems to contain oil in solution.

The charry matter in the retort amounts to 0.05 of the marrow distilled. It is dark brown, heavy, and brilliant. It is incinerated with difficulty, and leaves an ash consisting of phosphate of lime, carbonate of lime, and some soda.

Marrow combines with alkalies and forms soap. Boiling alcohol and ether dissolve a small portion of it, which precipitates again as soon as the solution cools.

Composition.

Marrow, from the thigh bone of an ox, was found, by Berzelius, to be composed of the following substances:

Pure marrow	0.96
Skins and blood-vessels	0.01
Albumen	0.03
Gelatine	
Extractive	
Peculiar matter	
Water	
	1.00

From the preceding detail, it appears, that pure marrow is a species of fixed oil, possessing peculiar properties, and approaching somewhat to butter in its nature.

Sect. VIII. *Of Hair and Feathers.*

These substances cover different parts of animals, and are obviously intended by nature to protect them from the cold. For this, their softness and pliability, and the slowness with which they conduct heat, render them peculiarly proper.

Hair.

1. *Hair* is usually distinguished into various kinds, according to its size and appearance. The strongest and stiffest of all is called *bristle*; of this kind is the hair on the backs of hogs. When remarkably fine, soft, and pliable, it is called *wool*; and the finest of all is known by the name of *down*. But all these varieties resemble one another very closely in their composition.

Vauquelin has lately published a curious set of experiments on the analysis of human hair of various colours. Though hair is insoluble in boiling water, he obtained a solution by raising the temperature of the liquid in a Papin's digester. If the heat thus produced was too great, the hair was decomposed, and ammonia, carbonic acid, and an empyreumatic oil formed. Sulphureted hydrogen is always evolved, and its quantity increases with the heat. When hair is thus dissolved in water heated above the boiling point, the solution contains a kind of bituminous oil, which is deposited very slowly. This oil was black when the hair dissolved was black, but yellowish red when red hair was employed.

When the solution is filtered to get rid of this oil, the liquid which passes through is nearly colourless. Copious precipitates are formed in it by the infusion of nutgalls and oxymuriatic acid. Silver is blackened by it, and acetate of lead precipitated brown. Acids render it turbid, but the precipitate is re-dissolved, by adding these liquids in excess. Though very much concentrated by evaporation, it does not concrete into a jelly.

Water containing only four per cent. of potash dissolves hair, while hydrosulphuret of ammonia is evolved. If the hair be black, a thick dark-coloured oil, with some sulphur and iron, remains undissolved; if the hair be red, there remains a yellow oil, with some sulphur and an atom or two of iron. When acids are dropt into this solution, they throw down a white matter soluble in an excess of acid.

Sulphuric and muriatic acids become red when first poured on hair, and gradually dissolve it. Nitric acid turns hair yellow and dissolves it, while an oil separates, which is red or black according to the colour of the hair dissolved. The solution yields a great deal of oxalic acid, and contains, besides, bitter principle, iron, and sulphuric acid. Oxymuriatic acid first whitens hair, and then reduces it to a substance of the consistence of turpentine, and partly soluble in alcohol.

When alcohol is digested on black hair, it extracts from it two kinds of oil. The first, which is white, subsides in white shining scales as the liquor cools; the second is obtained by evaporating the alcohol. It has a greyish green colour, and at last becomes solid. From red hair alcohol likewise separates two oils; the first white as from black hair, and the other as red as blood. When the red hair is deprived of this oil, it becomes of a chesnut colour. Hence its red colour is obviously owing to the red oil.

When hair is incinerated, it yields iron and manganese, phosphate, sulphate, and carbonate of lime, muriate of soda, and a considerable portion of silica. The ashes of red hair contain less iron and manganese: those of white hair still less; but in them we find magnesia, which is wanting in the other varieties of hair. The ashes of hair do not exceed 0.015 of the hair.

Composition of black hair.

From the preceding experiments of Vauquelin, we learn that black hair is composed of the nine following substances:

1. An animal matter, constituting the greatest part.
2. A white solid oil, small in quantity.
3. A greyish green oil, more abundant.
4. Iron; state unknown.

5. Oxide of manganese.
6. Phosphate of lime.
7. Carbonate of lime, very scanty.
8. Silica.
9. Sulphur.

The colouring matter of hair appears from Vauquelin's experiments to be an oil. The oil is blackish green in black hair, red in red hair, and white in white hair. Vauquelin supposes that sulphureted iron contributes to the colour of dark hair; and ascribes to the presence of an excess of sulphur the property which white and red hair have of becoming black with the oxides of the white metals. The sudden change of colour in hair from grief, he thinks, is owing to the evolution of an acid.

Feathers.

2. *Feathers* seem to possess nearly the same properties with hair. Mr Hatchett has ascertained that the quill is composed chiefly of coagulated albumen. Though feathers were boiled for a long time in water, Mr Hatchett could observe no traces of gelatine.

Having given the preceding account of the solids which compose animal bodies, we proceed next to the fluid which circulates through living bodies, namely *blood;* and to the various *secretions* formed from the blood, either in order to answer some important purpose to the animal, or to be evacuated as useless, that the blood thus purified may be more proper for answering the ends for which it was destined. Many of these substances have been examined with more care by chemists than the animal solids.

Sect. IX. *Of Blood.*

Blood. Its properties.

Blood is a well known fluid, which circulates in the veins and arteries of the more perfect animals. It is of a red colour, has a considerable degree of consistency, and an unctuous feel, as if it contained a quantity of soap. Its taste is slightly saline, and it has a peculiar smell.

The specific gravity of human blood is, at a medium, 1.0527.

When blood, after being drawn from an animal, is allowed to remain for some time at rest, it very soon coagulates into a solid mass of the consistence of curdled milk. This mass gradually separates into two parts; one of which is fluid, and is called *serum;* the other, the coagulum, has been called *cruor,* because it alone retains the red colour which distinguishes blood. This separation is very similar to the separation of curdled milk into curds and whey.

Serum.

1. The serum is of a light greenish yellow colour; it has the taste, smell, and feel of the blood, but its consistence is not so great. Its mean specific gravity is about 1.0287. It converts syrup of violets to a green, and therefore contains an alkali. On examination, Rouelle found that it owes this property to a portion of soda. When heated to the temperature of 156°, the serum coagulates, as Harvey first discovered. It coagulates also when boiling water is mixed with it; but if serum be mixed with six parts of cold water, it does not coagulate by heat. When thus coagulated, it has a greyish white colour, and is not unlike the boiled white of an egg. If the coagulum be cut into small pieces, a muddy fluid may be squeezed from it, which has been termed the *serosity.* After the separation of this fluid, if the residuum be carefully washed in boiling water and examined, it will be found to possess all the properties of coagulated *albumen.* The serum, therefore, contains a considerable proportion of albumen. Hence its coagulation by heat, and the other phenomena which albumen usually exhibits.

If the coagulated serum be heated in a silver vessel, the surface of the silver becomes black, being converted into a sulphuret. Hence it is evident, that it contains sulphur; and Proust has ascertained, that it is combined with ammonia in the state of a hydrosulphuret.

If serum be mixed with twice its weight of water, and, after coagulation by heat, the albumen be separated by filtration, and the liquid be slowly evaporated till it is considerably concentrated, a number of crystals are deposited when the liquid is left standing in a cool place. These crystals, first examined by Rouelle, consist of carbonate of soda, muriate of soda, besides phosphate of soda and phosphate of lime. The soda exists in the blood in a caustic state, and seems to be combined with the gelatine and albumen. The carbonic acid combines with it during evaporation.

Cruor.

2. The cruor, or *clot* as it is sometimes called, is of a red colour, and possesses considerable consistence. Its mean specific gravity is about 1.245. If this cruor be washed carefully, by letting a small jet of water fall upon it till the water runs off colourless, it is partly dissolved, and partly remains upon the searce. Thus it is separated into two portions: namely, 1. A white, solid, elastic substance, which has all the properties of *fibrin;* 2. The portion held in solution by the water, which consists of the colouring matter, not however in a state of purity, for it is impossible to separate the cruor completely from the serum.

Bucquet proved that this watery solution contained albumen and iron. Menghini had ascertained, that if blood be evaporated to dryness by a gentle heat, a quantity of iron may be separated from it by the magnet. The quantity which he obtained was considerable: according to him, the blood of a healthy man contains above two ounces of it. Now, as neither the serum nor the fibrin extracted from the cruor contains iron, it follows of course, that the water holding the colouring matter in solution must contain the whole of that metal.

This watery solution gives a green colour to syrup of violets. When exposed to the air, it gradually deposites flakes, which have the properties of albumen. When heated, a brown-coloured scum gathers on its surface. If it be evaporated to dryness, and then mixed with alcohol, a portion is dissolved, and the alcoholic solution yields by evaporation a residuum, which lathers like soap in water, and tinges vegetable blues green; the acids occasion a precipitate from its solution. This substance is a compound of albumen and soda. Thus we see that the watery solution contains albumen, iron, and soda.

Fourcroy and Vauquelin have ascertained, that the iron is combined with phosphoric acid, and in the state of subphosphate of iron; thus confirming an opinion which had been maintained by Sage, and announced as a fact by Gren.

Brande has lately shown, that the colouring matter of the blood is of an animal nature. He has proved, that it may be advantageously used as a dye-stuff.

Such are the properties of blood, as far as they have been hitherto ascertained by experiment. We have seen that it contains the following ingredients:

1. Water.
2. Fibrin.
3. Albumen.
4. Hydrosulph. of ammonia.
5. Soda.
6. Subphosphate of iron.
7. Muriate of soda.
8. Phosphate of soda.
9. Phosphate of lime.

Besides benzoic acid, which has been detected by Proust.

SECT. X. *Of Milk.*

Milk.

Milk is a fluid secreted by the female of all those animals denominated *mammalia*, and intended evidently for the nourishment of her offspring.

The milk of every animal has certain peculiarities which distinguish it from every other milk. But the animal whose milk is most made use of by man as an article of food, and with which, consequently, we are best acquainted, is the *cow*. Chemists, therefore, have made choice of cow's milk for their experiments.

Properties of cow's milk.

Milk is an opaque fluid, of a white colour, a slight peculiar smell, and a pleasant sweetish taste. When newly drawn from the cow, it has a taste very different from that which it acquires, after it has been kept for some hours. It reddens vegetable blues.

When milk is allowed to remain for some time at rest, there collects on its surface a thick unctuous yellowish-coloured substance, known by the name of cream.

After the cream is separated, the milk which remains is much thinner than before, and it has a bluish white colour. If it be heated to the temperature of 100°, and a little *rennet*, which is water digested with the inner coat of a calf's stomach, and preserved with salt, be poured into it, coagulation ensues; and if the coagulum be broken, the milk very soon separates into two substances; a solid white part known by the name of *curd*, and a fluid part called *whey*. Thus we see that milk may be easily separated into three parts; namely, *cream*, *curd*, and *whey*.

Cream.

1. Cream is of a yellow colour, and its consistence increases gradually by exposure to the atmosphere. In three or four days it becomes so thick, that the vessel which contains it may be inverted without risking any loss. In eight or ten days more, its surface is covered over with mucors and byssi, and it has no longer the flavour of cream, but of very fat cheese.

Cream possesses many of the properties of an oil. It is specifically lighter than water; it has an unctuous feel, stains cloths precisely in the manner of oil; and if it be kept fluid, it contracts at last a taste which is very analogous to the rancidity of oils. These properties are sufficient to show us that it contains a quantity of oil; but this oil is combined with a part of the curd, and mixed with some serum. Cream, then, is composed of a peculiar oil, curd, and serum. The oil may be easily obtained separate, by agitating the cream for a considerable time. This process, known to every body, is called *churning*. After a certain time, the cream separates into two portions: one fluid, and resembling creamed milk; the other solid, and called *butter*.

Butter.

Butter is of a yellow colour, possesses the properties of an oil, and mixes readily with other oily bodies. When heated to the temperature of 96° it melts, and becomes transparent; if it be kept for some time melted, some curd and water or whey separate from it, and it assumes exactly the appearance of oil. But this process deprives it in a great measure of its peculiar flavour.

Butter may be obtained, by agitating cream newly taken from milk, or even by agitating milk newly drawn from the cow. But it is usual to allow cream to remain for some time before it is churned. Now cream, by standing, acquires a sour taste; butter, therefore, is commonly made from sour cream. When very sour cream is churned, every one must have perceived, that the butter milk, after the churning, is not nearly so sour as the cream had been. The butter, in all cases, is perfectly sweet; consequently the acid which had been evolved, has in a great measure disappeared during the progress of churning. It has been ascertained that cream may be churned, and butter obtained, though the contact of atmospheric air be excluded. On the other hand, it has been affirmed, that when cream is churned in contact with air, it absorbs a considerable quantity of it.

In many cases, there is a considerable extrication of gas during the churning of water. From the phenomena, it can scarcely he doubted that this acid is carbonic acid. See BUTTER.

Curd.

2. Curd, which may be separated from creamed milk by rennet, has many of the properties of coagulated albumen. It is white and solid; and when all the moisture is squeezed out, it has a good deal of brittleness. It is insoluble in water; but pure alkalies and lime dissolve it readily, especially when assisted by heat; and when fixed alkali is used, a great quantity of ammonia is emitted during the solution. The solution of curd in soda is of a red colour, at least if heat be employed, owing probably to the separation of charcoal from the curd by the action of the alkali. The matter dissolved by the alkali may be separated from it by means of an acid; but it has lost all the properties of curd. It is of a black colour, melts like tallow by the application of heat, leaves oily stains on paper, and never acquires the consistence of curd. Its constituents, according to the experiments of Thenard and Gay-Lussac, are as follows:

Carbon	59.781
Oxygen	11.409
Hydrogen	7.429
Azote	21.381
	100

Cheese.

Curd, as is well known, is used in making *cheese*, and the cheese is the better the more it contains of cream, or of that oily matter which constitutes cream. It is well known to cheesemakers, that the goodness of it depends in a great measure on the manner of separating the whey from the curd. If the milk be much heated, the coagulum broken in pieces, and the whey forcibly separated, as is the practice in many parts of Scotland, the cheese is scarce good for any thing; but the whey is delicious, especially the last squeezed out whey, and butter may be obtained from it in considerable quantity:—a full proof that nearly the whole creamy part of the milk has been separated with the whey. Whereas if the milk be not too much heated, (about 100° is sufficient,) if the coagulum be allowed to remain unbroken, and the whey be separated by very slow and gentle pressure, the cheese is excellent; but the whey is almost transparent, and nearly colourless.

Good cheese melts at a moderate heat; but bad cheese, when heated, dries, curls, and exhibits all the phenomena of burning horn. From this it is evident, that good cheese contains a quantity of the peculiar oil which constitutes the distinguishing characteristic of cream; hence its flavour and smell. Proust has found in cheese an acid which he calls the *caseic* acid, to which he ascribes several of the peculiar properties of cheese. See DAIRY.

Whey.

3. Whey, after being filtered, to separate a quantity of curd which still continues to float through it, is a thin pellucid fluid, of a yellowish green colour, and pleasant sweetish taste, in which the flavour of milk may be distinguished. It always contains some curd; but nearly the whole may be separated by keeping the whey for some time boiling; a thick white scum gathers on the surface, which in Scotland is known by the name of *float whey*. When this scum, which consists of the curdy part, is carefully separated, the whey, after being allow-

ed to remain at rest for some hours, to give the remainder of the curd time to precipitate. is decanted off almost as colourless as water, and scarcely any of the peculiar taste of milk can be distinguished in it. If it be now slowly evaporated, it deposites at last a number of white-coloured crystals, which are *sugar of milk*. Toward the end of the evaporation, some crystals of muriate of potash and of muriate of soda make their appearance. According to Scheele, it contains also a little phosphate of lime, which may be precipitated by ammonia.

The recent experiments of Fourcroy and Vauquelin, Thenard, and Bouillon La Grange, have added considerably to our knowledge of the constituents of whey. It always reddens vegetable blues, containing a portion of acetic acid. The lactic acid of Scheele is nothing else than this acid holding an animal matter in solution. It contains likewise some phosphate of magnesia and phosphate of iron, as Fourcroy and Vauquelin have discovered. Sulphate of potash, likewise, and a peculiar extractive matter, have been separated from it.

Composition of cow's milk.

Thus we see that cow's milk is composed of the following ingredients:

1. Water.
2. Oil.
3. Curd.
4. Extractive.
5. Sugar of milk.
6. Acetic acid.
7. Muriate of soda.
8. Muriate of potash.
9. Sulphate of potash.
10. Phosphate of lime.
11. Phosphate of magnesia.
12. Phosphate of iron.

The milk of all other animals, as far as it has hitherto been examined, consists nearly of the same ingredients; but there is a very great difference in their proportion.

Sect. XI. *Of Saliva.*

Saliva.

The fluid secreted in the mouth, which flows in considerable quantity during a repast, is known by the name of *saliva*.

Its properties.

Saliva is a limpid fluid like water, but much more viscid. It has neither smell nor taste. Its specific gravity, according to Hamberger, is 1.0167; according to Siebold, 1.080. When agitated, it froths like all other adhesive liquids; indeed it is usually mixed with air, and has the appearance of froth.

It neither mixes readily with water nor oil; but by trituration in a mortar, it may be so mixed with water as to pass through a filter. It has a great affinity for oxygen, absorbs it readily from the air, and gives it out again to other bodies.

When boiled in water, a few flakes of albumen precipitate. From the experiments of Dr Bostock, we learn that this albumen is not in a state of solution. It is separated by the filter, and subsides of its own accord when the liquid is diluted with water. In his analysis, this coagulated albumen amounted to 0.4 of the solid matter contained in the saliva examined.

When saliva is evaporated, it swells exceedingly, and leaves behind it a thin brown coloured crust; but if the evaporation be conducted slowly, small cubic crystals of muriate of soda are formed. The viscidity of saliva, the property which it has of absorbing oxygen, and of being inspissated, announce the presence of mucus as a component part. This is fully confirmed by the effect of neutral acetate of lead, which produces a copious precipitate in saliva. Dr Bostock considers the mucus as constituting about one-half of the solid contents of saliva.

When saliva is distilled in a retort, it froths very much; 100 parts yield 80 parts of water nearly pure, then a little carbonate of ammonia, some oil, and an acid, which perhaps is the prussic. The residuum amounts to about 1.56 part, and is composed of muriate of soda, phosphate of soda, and phosphate of lime.

The acids and alcohol inspissate saliva; the alkalies disengage ammonia; oxalic acid precipitates lime; and the nitrates of lead, mercury, and silver, precipitate phosphoric and muriatic acids.

From these facts, it follows that saliva, besides water, which constitutes at least four-fifths of its bulk, contains the following ingredients:

Composition.

1. Mucilage.
2. Albumen.
3. Muriate of soda.
4. Phosphate of soda.
5. Phosphate of lime.
6. Phosphate of ammonia.

But it cannot be doubted, that, like all the other animal fluids, it is liable to many changes from disease, &c. Brugnatelli found the saliva of a patient labouring under an obstinate venereal disease impregnated with oxalic acid.

Sect. XII. *Of Bile.*

Bile.

Bile is a liquid of a yellowish green colour, an unctuous feel, bitter taste, and peculiar smell, which is secreted by the liver; and, in most animals, considerable quantities of it are usually found collected in the gall bladder.

Ox bile.

1. Ox bile is a liquid of a yellowish green, and sometimes of a deep green colour. Its taste is very bitter, but at the same time sweetish. Its smell is feeble, but peculiar and disagreeable. It does not act on vegetable blues. Its consistence varies very much. Sometimes it is a thin mucilage; sometimes very viscid and glutinous; sometimes it is perfectly transparent; and sometimes it contains a yellow-coloured matter, which precipitates when the bile is diluted with water.

When an acid is added to bile, even in a minute quantity, it acquires the property of reddening vegetable blues. The addition of a little more acid occasions a precipitate, and sulphuric acid occasions a greater precipitate than any other acid. This precipitate consists of a yellow-coloured matter often visible in bile, and which is insoluble in water. It contains also a little resin, which gives it a bitter taste. Acids do not throw down the whole resin from bile. Yet if the resin be dissolved in soda, it is readily precipitated by all the acids; a proof that the resin is not kept in solution in bile by soda.

When superacetate of lead is poured into bile, a copious white precipitate falls, consisting of the resin combined with the oxide of lead. The superacetate of commerce does not readily throw down the whole resin; but if eight parts of common sugar of lead and one part of litharge be united together by digestion in water, a salt is formed, which readily throws down the whole of the resin. If the precipitate be treated with diluted nitric acid, the lead is separated, and the resin remains behind in a state of purity. It is a green-coloured bitter tasted substance, possessing most of the properties of resins. It has been already described in the preceding Section. One hundred parts of bile contain about three parts of resin.

If acetate of lead be poured into bile thus deprived of its resin by the superacetate, a new and more copious precipitate falls, consisting of the oxide of lead united to a peculiar substance, which gives bile most of its characters. This substance was first described in detail by Thenard, who has given it the name of *picromel*. The compound, consisting of oxide of lead and picromel, is soluble in acetic acid. If a current of sulphureted hydrogen gas be passed through the solution, the lead is separated; and by filtering and evaporating the liquid to dryness, the picromel is obtained in a separate state. When bile, mixed with muriatic acid and filtered, is set aside for some months in an open vessel, I have seen the picromel separate of its own accord. It is a white solid substance in small globules. It has a sweet, and at the same time an acrid taste, and is often somewhat bitter from retaining a portion of the resin. It facilitates the solution of resin in water: three parts of picromel and one part of resin dissolve in water.

By evaporating a quantity of bile to dryness, calcining it, and proceeding in the usual way, Thenard ascertained the proportion of salts which it contained. The following was the result of his analysis of 800 parts of bile:

Composition.

700.0 water.
24.0 resin.
60.3 picromel.
4.5 yellow matter.
4.0 soda.
2.0 phosphate of soda.
3.2 muriate of soda.
0.8 sulphate of soda.
1.2 phosphate of lime.
oxide of iron, a trace.

800.0

Bile of the calf, dog, &c.

2. Such are the properties and the constituents of ox bile, as far as they have been examined by Thenard. From the experiments of the same chemist, it appears that the bile of the calf, the dog, the sheep, and the cat, resemble that of the ox exactly, both in their properties and their constituents.

Bile of the sow.

3. The bile of the sow differs entirely from that of all these animals. It contains neither albumen, nor animal matter, nor picromel, but is merely a soap, as it contains a great quantity of resin and of soda, and is decomposed with facility by all the acids, even by vinegar. It contains traces also of several salts; but Thenard did not ascertain their nature.

Bile of the hen, &c.

4. The bile of the common hen, of the turkey, and the duck, has a good deal of resemblance to that of quadrupeds. But it differs in the following particulars: 1. It contains a considerable quantity of albumen; 2. The picromel has no sensible sweet taste, but is very acrid and bitter; 3. It contains very little soda; 4. The resin is not precipitated by common superacetate of lead; but superacetate, boiled with one-fourth of its weight of litharge, occasions it to precipitate.

Bile of the thornback and salmon.

5. The bile of the thornback and salmon is yellowish white. When evaporated, it leaves a matter which has a very sweet and slightly acrid taste. It appears to contain no resin. The bile of the carp and the eel is very green, very bitter, contains little or no albumen, but yields soda, resin, and a sweet acrid matter similar to that which may be obtained from salmon bile.

Human bile.

6. Human bile differs considerably from that of all other animals examined. Its taste is not very bitter. It is seldom completely liquid, but usually contains some yellow matter suspended in it. When evaporated to dryness, it leaves a brown matter amounting to about $\frac{1}{11}$th of the original weight. All the acids decompose human bile, and throw down a copious precipitate consisting of albumen and resin. The following were the proportions of the constituents obtained by Thenard from 1100 parts of human bile.

Composition.

1000.0 water.
from 2 to 10 yellow insoluble matter.
yellow matter in solution, a trace.
42.0 albumen.
41.0 resin.
5.6 soda.
4.5 phosphate of soda, sulphate of soda, muriate of soda, phosphate of lime, oxide of iron.

Sect. XIII. *Of the Cerumen of the Ear.*

Cerumen of the ear.

Cerumen is a viscid yellow-coloured liquid secreted by the glands of the auditory canal, which gradually becomes concrete by exposure to the air.

Its properties.

It has an orange yellow colour, and a bitter taste. When slightly heated upon paper, it melts, and stains the paper like an oil; at the same time it emits a slightly aromatic odour. On burning coals it softens, and emits a white smoke, which resembles that given out by burning fat; it afterwards melts, swells, becomes dark coloured, and emits an ammoniacal and empyreumatic odour. A light coal remains behind.

When agitated in water, cerumen forms a kind of emulsion, which soon putrefies, depositing at the same time white flakes.

Alcohol, when assisted by heat, dissolves five-eighths of the cerumen; the three-eighths which remain behind have the properties of albumen, mixed however with a little oily matter. When the alcohol is evaporated, it leaves a deep orange residuum of a very bitter taste, having a smell and a consistence analogous to turpentine. It melts when heated, evaporates in a white smoke without leaving any residuum, and, in short, resembles very strongly the *resin of bile*. Ether also dissolves this oily body; but it is much less bitter, and much lighter coloured. When the albuminous part of cerumen is burnt, it leaves traces of soda and of phosphate of lime. From these facts, Vauquelin considers cerumen as composed of the following substances:

Composition.

1. Albumen.
2. An inspissated oil.
3. A colouring matter.
4. Soda.
5. Phosphate of lime.

Sect. XIV. *Of Tears and Mucus.*

Tears.

1. The liquid called tears is transparent and colourless like water; it has scarcely any smell, but its taste is always perceptibly salt. Its specific gravity is somewhat greater than that of distilled water. It gives to paper stained with the juice of the petals of mallows or violet a permanently green colour, and therefore contains a fixed alkali. It unites with water, whether cold or hot, in all proportions. Alkalies unite with it readily, and render it more fluid. The mineral acids produce no apparent change upon it. Exposed to the air, this liquid gradually evaporates, and becomes thicker. When nearly reduced to a state of dryness, a number of cubic crystals form in the midst of a kind of mucilage. These crystals possess the properties of muriate of soda; but they tinge vegetable blues green, and therefore contain an excess of soda. The mucilaginous matter acquires a yellowish colour as it dries.

When alcohol is poured into this liquid, a mucilaginous matter is precipitated in the form of large white flakes. The alcohol leaves behind it, when evaporated, traces of muriate of soda and soda. The residuum which remains behind, when inspissated tears are burnt in the open air, exhibits some traces of phosphate of lime, and phosphate of soda.

Thus it appears, that tears are composed of the following ingredients:

1. Water.
2. Mucus.
3. Muriate of soda.
4. Soda.
5. Phosphate of lime.
6. Phosphate of soda.

The saline parts amount only to about 0.01 of the whole, or probably not so much.

Mucus of the nose.

2. The mucus of the nose has also been examined by Fourcroy and Vauquelin. They found it composed of precisely the same ingredients with the tears. As this fluid is more exposed to the action of the air than the tears, in most cases its mucilage has undergone less or more of that change which is the consequence of the absorption of oxygen. Hence the reason of the greater viscidity and consistence of the mucus of the nose; hence also the great consistence which it acquires during colds, where the action of the atmosphere is assisted by the increased action of the parts.

3. As to the mucus which lubricates the alimentary canal, the trachea, the bronchiæ, the urethra, and all the different cavities of the body, nobody has hitherto subjected it to analysis, because it cannot be obtained in sufficient quantity. It is viscid, and no doubt contains a mucilaginous substance, similar to that contained in the saliva, the tears, and the mucus of the nose; as, like these liquids, it is liable to become much more thick by exposure to the air.

SECT. XV. *Liquor of the Pericardium.*

Liquor of the pericardium.

This is a liquor which lubricates the heart. It has been lately examined by Dr Bostock, having been obtained from the pericardium of a boy who had died suddenly.

Its properties.

It had the colour and appearance of the serum of the blood. Evaporated to dryness, it left a residue amounting to $\frac{1}{11}$th of its weight. When exposed to the heat of boiling water, it became opake and thready. It was copiously precipitated by oxymuriate of mercury before boiling; but when boiled, evaporated to dryness, and redissolved, the solution was not affected by oxymuriate of mercury. These experiments show us that it contained albumen. When saturated with oxymuriate of mercury, infusion of galls produced no effect, indicating the absence of gelatine. It was copiously precipitated by neutral acetate of lead, even after being boiled to dryness, and the residue re-dissolved in water. Nitrate of silver indicated the presence of muriatic acid. Dr Bostock, from his experiments, considers it composed of

Composition.

Water	92.0
Albumen	5.5
Mucus	2.0
Muriate of soda	0.5
	100.0

SECT. XVI. *Of the Humours of the Eye.*

Humours of the eye.

The eye is one of the most delicate and complicated organs in the body; at the same time its structure, and the uses of its parts, are better understood than almost any of the other instruments of sensation. It is composed of several concentric coats, which have not been chemically examined; but, from the experiments of Hatchett on similar substances, we may consider it as probable that they possess the properties of coagulated albumen. The internal part of the eye is chiefly filled with three transparent substances, which have been called *humours* by anatomists; namely, 1. The *aqueous humour*, immediately behind the cornea; 2. The *crystalline humour*, or *lens*; and, 3. The *vitreous humour*, behind the lens, and occupying the greatest part of the eye.

1. The aqueous humour of the eye of the sheep is a clear transparent liquid like water, which has very little smell or taste when fresh. Its specific gravity is 1.0090 at the temperature of 60°. It appears to be water slightly impregnated with the following substances:

1. Albumen. 2. Gelatine. 3. Muriate of soda.

2. The vitreous matter possesses the very same properties as the aqueous; even its specific gravity is the same, or only a very little greater.

3. The crystalline lens is solid: densest in the centre, and becoming less solid towards the circumference. It is composed of concentric coats, and is transparent. Its specific gravity is 1.1000. When fresh, it has little taste. It putrefies very rapidly.

It is almost completely soluble in water. The solution is partly coagulated by heat, and gives a copious precipitate with tannin, both before the coagulation and after it. It gives no traces of muriatic acid. Hence it is composed of albumen and gelatine united to water. According to Nicholas, the quantity of gelatine diminishes as we approach the centre of the lens, where it is very small. He detected phosphate of lime likewise in every part of the lens.

The humours of the human eye are composed of the same ingredients as those of the sheep; the only perceptible difference consists in their specific gravity. The specific gravity of the human aqueous and vitreous humours is 1.0053; that of the crystalline 1.0790.

The humours of the eyes of oxen resemble those of the sheep in their composition. The specific gravity of the aqueous and vitreous humours is 1.0088; that of the crystalline 1.0765.

SECT. XVII. *Of Sinovia.*

Sinovia.

Within the capsular ligament of the different joints of the body there is contained a peculiar liquid, intended evidently to lubricate the parts, and to facilitate their motion. This liquid is known among anatomists by the name of *sinovia*.

Its properties.

The sinovia of the ox, when it has just flowed from the joint, is a viscid semitransparent fluid, of a greenish white colour, and a smell not unlike frog-spawn. It very soon acquires the consistence of jelly; and this happens equally whether it be kept in a cold or a hot temperature, whether it be exposed to the air or excluded from it. This consistence does not continue long; the sinovia soon recovers again its fluidity, and at the same time deposites a thready-like matter.

Sinovia mixes readily with water, and imparts to that liquid a great deal of viscidity. The mixture froths when agitated; becomes milky when boiled, and deposites some pellicles on the sides of the dish; but its viscidity is not diminished.

When alcohol is poured into sinovia, a white substance precipitates, which has all the properties of albumen. One hundred parts of sinovia contain 4.52 of albumen. The liquid still continues as viscid as ever; but if acetic acid be poured into it, the viscidity disappears altogether, the liquid becomes transparent, and deposites a quantity of matter in white threads, which possesses the following properties: 1. It has the colour, smell, taste, and elasticity of vegetable gluten. 2. It is soluble in concentrated acids and pure alkalies. 3. It is soluble in cold water; the solution froths. Acids and alcohol precipitate the fibrous matter in flakes. One hundred parts of sinovia contain 11.86 of this matter.

Margueron found that 100 parts of sinovia contained about 0.71 of soda.

When sinovia is exposed to a dry atmosphere, it gradually evaporates, and a scaly residuum remains, in which cubic crystals, and a white saline efflorescence, are apparent. The cubic crystals are muriate of soda. One hundred parts of sinovia contain 1.75 of this salt. The saline efflorescence is carbonate of soda.

Composition.

From the analysis of Mr Margueron, it appears that sinovia is composed of the following ingredients:

11.86	fibrous matter,
4.52	albumen,
1.75	muriate of soda,
.71	soda,
.70	phosphate of lime,
80.46	water.
100.00	

SECT. XVIII. *Of Semen.*

Semen.

The peculiar liquid secreted in the testes of males, and destined for the impregnation of females, is known by the name of *semen*.

Semen, when newly ejected, is evidently a mixture of two different substances; the one fluid and milky, which is supposed to be secreted by the prostate gland; the other, which is considered as the true secretion of the testes, is a thick mucilaginous substance, in which numerous white shining filaments may be discovered. It has a slight disagreeable odour, an acrid irritating taste, and its specific gravity is greater than that of water. When rubbed in a mortar, it becomes frothy, and of the consistence of pomatum, in consequence of its enveloping a great number of air bubbles. It converts paper stained with the blossoms of mallows or violets to a green colour, and consequently contains an alkali.

As the liquid cools, the mucilaginous part becomes transparent, and acquires greater consistency; but in about twenty minutes after its emission, the whole becomes perfectly liquid. This liquefaction is not owing to the absorption of moisture from the air, for it loses instead of acquiring weight during its exposure to the atmosphere; nor is it owing to the action of the air, for it takes place equally in close vessels.

When oxymuriatic acid is poured into semen, a number of white flakes precipitate, and the acid loses its peculiar odour. These flakes are insoluble in water, and even in acids. If the quantity of acid be sufficient, the semen acquires a yellow colour. Thus it appears that semen contains a mucilaginous substance analogous to that of the tears, which coagulates by absorbing oxygen. Mr Vauquelin obtained from 100 parts of semen six parts of this mucilage.

When semen is exposed to the air about the temperature of 60°, it becomes gradually covered with a transparent pellicle, and in three or four days deposites small transparent crystals, often crossing each other in such a manner as to represent the spokes of a wheel. These crystals, when viewed through a microscope, appear to be four sided prisms, terminated by very long four-sided pyramids. They may be separated by diluting the liquid with water, and decanting it off. They have all the properties of phosphate of lime. If, after the appearance of these crystals, the semen be still allowed to remain exposed to the atmosphere, the pellicle on its surface gradually thickens, and a number of white round bodies appear on different parts of it. These bodies also are phosphate of lime, prevented from crystallizing regularly by the too rapid abstraction of moisture. Mr Vauquelin found that 100 parts of semen contain three parts of phosphate of lime. If, at this period of the evaporation, the air becomes moist, other crystals appear in the semen, which have the properties of carbonate of soda. The evaporation does not go on to complete exsiccation, unless at the temperature of 77°, and when the air is very dry. When all the moisture is evaporated, the semen has lost 0.9 of its weight; the residuum is semitransparent like horn, and brittle.

Composition.

Thus it appears that semen is composed of the following ingredients:

90	water.
6	mucilage.
3	phosphate of lime.
1	soda.
100	

SECT. XIX. *Of Animal Poisons.*

Animal poisons.

Several animals are furnished with liquid juices of a poisonous nature, which, when poured into fresh wounds, occasion the disease or death of the wounded animal. Serpents, bees, scorpions, spiders, are well known examples of such animals. The chemical properties of these poisonous juices deserve peculiar attention; because it is only from such an investigation that we can hope to explain the fatal changes which they induce on the animal economy, or to discover an antidote sufficiently powerful to counteract their baneful influence. Unfortunately the task is difficult, and perhaps surpasses our chemical powers. For the progress already made in the investigation, we are indebted almost entirely to the labours of Fontana.

Poison of the viper,

1. The poison of the viper is a yellow liquid, which lodges in two small vesicles in the animal's mouth. These communicate by a tube with the crooked fangs, which are hollow, and terminate in a small cavity. When the animal bites, the vesicles are squeezed, and the poison is forced through the fangs into the wound.

This poisonous juice occasions the fatal effects of the viper's bite. It has a yellow colour, has no taste; but when applied to the tongue occasions numbness. It has the appearance of oil before the microscope, but it unites readily with water. It produces no change on vegetable blues.

When exposed to the open air, the watery part gradually evaporates, and a yellowish-brown substance remains, which has the appearance of gum arabic. In this state it feels viscid like gum between the teeth; it dissolves readily in water, but not in alcohol; and alcohol throws it down in a white powder from water. Neither acids nor alkalies have much effect upon it. It does not unite with volatile oils nor sulphuret of potash. When heated it does not melt, but swells, and does not inflame till it has become black. These properties are similar to the properties of gum, and indicate the gummy nature of this poisonous substance. Fontana made a set of experiments on the dry poison of the viper, and a similar set on gum arabic, and obtained the same results.

From the late observations of Dr Russel, there is reason to believe that the poisonous juices of the other serpents are similar in their properties to those of the viper.

This striking resemblance between gums and the poison of the viper, two substances of so opposite a nature in their effects upon the living body, is a humiliating proof of the small progress we have made in the chemical knowledge of these intricate substances. The poison of the viper, and of serpents in general, is most hurtful when mixed with the blood. Taken into the stomach it kills if the quantity be considerable. Fontana has ascertained that its fatal effects are proportional to its quantity, compared with the quantity of the blood. Hence the danger diminishes as the size of the animal increases. Small birds and quadrupeds die immediately when they are bitten by a viper; but to a full-sized man the bite seldom proves fatal.

Ammonia has been proposed as an antidote to the bite of the viper. It was introduced in consequence of the theory of Dr Mead, that the poison was of an acid nature. The numerous trials of that medicine by Fontana robbed it of all its celebrity; but it has been lately revived and recommended by Dr Ramsay as a certain cure for the bite of the rattlesnake.

Bee and wasp,

2. The venom of the bee and the wasp is also a liquid contained in a small vesicle, forced through the hollow tube of the sting into the wound inflicted by that instrument. From the experiments of Fontana, we learn that it bears a striking resemblance to the poison of the viper. That of the bee is much longer in drying when exposed to the air than the venom of the wasp.

Scorpion,

3. The poison of the scorpion resembles that of the viper also. But its taste is hot and acrid, which is the case also with the venom of the bee and the wasp.

And spider tribe.

4. No experiments upon which we can rely have been made upon the poison of the spider tribe. From the rapidity with which these animals destroy their prey, and even one another, we cannot doubt that their poison is sufficiently virulent.

Sect. XX. *Of Sweat.*

Sweat.

A quantity of matter is constantly emitted from the skin; this matter is invisible, and is distinguished by the name of *perspiration*. Several experiments were made by Lavoisier and Seguin to ascertain its amount. Mr Cruickshanks made numerous trials to determine its nature, and it has been lately subjected to a chemical examination by Thenard.

1. Mr Cruickshanks put his hand into a glass vessel, and luted its mouth at his wrist by means of a bladder. The interior surface of the vessel became gradually dim, and drops of water trickled down. By keeping his hand in this manner for an hour, he collected 30 grains of a liquid, which possessed all the properties of pure water. On repeating the same experiment at nine in the evening (thermometer 62°,) he collected only 12 grains. The mean of these is 21 grains. But as the hand is more exposed than the trunk of the body, it is reasonable to suppose that the perspiration from it is greater than that from the hand. Let us therefore take 30 grains per hour as the mean; and let us suppose, with Mr Cruickshanks, that the hand is $\frac{1}{60}$th of the surface of the body: The perspiration in an hour would amount to 1880 grains, and in 24 hours to 43,200 grains, or seven pounds six ounces troy. This is almost double of the quantity ascertained by Lavoisier and Seguin. Hence we may conclude that more matter is perspired through the hand than the other parts of the body, provided Mr Cruickshank's estimate of the ratio between the surface of the hand and body be not erroneous.

He repeated the experiment again after hard exercise, and collected in an hour 48 grains of water. He found also, that this aqueous vapour pervaded his stocking without difficulty; and that it made its way through a shamoy leather glove, and even through a leather boot, though in a much smaller quantity than when the leg wanted that covering.

2. Besides water, it cannot be doubted that *carbon* is also emitted from the skin; but in what state, the experiments hitherto made do not enable us to decide. Mr Cruickshanks found that the air of the glass vessel in which his hand and foot had been confined for an hour contained carbonic acid gas; for a candle burned dimly in it, and it rendered limewater turbid.

3. Besides water and carbon, or carbonic acid gas, the skin emits also a particular odorous substance. That every animal has a peculiar smell, is well known: the dog can discover his master, and even trace him to a distance, by the scent. A dog, chained some hours after his master had set out on a journey of some hundred miles, followed his footsteps by the smell, and found him on the third day in the midst of a crowd. But it is needless to multiply instances of this fact, they are too well known to every one. Now this smell must be owing to some peculiar matter which is constantly emitted; and this matter must differ somewhat either in quantity or some other property, as we see that the dog easily distinguishes the individual by means of it. Mr Cruickshanks has made it probable that this matter is an oily substance; or at least that there is an oily substance emitted by the skin. He wore repeatedly, night and day, for a month, the same vest of fleecy hosiery during the hottest part of the summer. At the end of this time he always found an oily substance accumulated in considerable masses on the nap of the inner surface of the vest, in the form of black tears. When rubbed on paper, it makes it transparent, and hardens on it like grease. It burns with a white flame, and leaves behind it a charry residuum.

4. Berthollet has observed the perspiration acid; and he has concluded that the acid which is present is the phosphoric: but that has not been proved. Indeed the late experiments of Thenard have proved that the acid in *perspired matter* is not the phosphoric, but the acetic. He employed the method practised by Mr Cruickshanks to collect this matter. Different persons wore clean flannel waistcoats next their skin for ten days, the waistcoats had been first washed with soap, then in pure water, then in water acidulated with muriatic acid, and lastly in a great quantity of pure wate. He steeped the waistcoats in hot distilled water, and thus separated from them the perspired matter. The liquid was put into a retort, and concentrated to the consistence of a syrup. The liquid which came over had a disagreeable smell, and reddened infusion of litmus. Kept in an open vessel it retained its transparency, but lost its odour. The residue in the retort had no smell. It was strongly acid, and tasted distinctly of common salt, while at the same time an acrid and hot flavour could be distinguished. When evaporated to dryness and strongly heated, the acid which it contained was dissipated or destroyed, and the residue consisted of common salt, charcoal, and minute traces of phosphate of lime, and oxide of iron. The same destruction of the acid took place if it was previously saturated with potash before it was heated to redness, and in that case the potash was converted into a carbonate. When saturated with an alkali, and distilled along with phosphoric acid, it yielded an acid which possessed all the characters of the acetic.

5. The small quantity of animal matter which Thenard found in the perspired matter, possessed characters which induced him to consider it as similar to gelatine in its nature.

SECT. XXI. *Of Urine.*

Urine.

Fresh urine differs considerably in its appearance, according to the state of the person, and the time at which it is voided. In general, healthy urine is a transparent liquid of a light amber colour, an aromatic odour resembling that of violets, and a disagreeable bitter taste. Its specific gravity varies, according to Mr Cruickshanks, from 1.005 to 1.033. When it cools, the aromatic smell leaves it, and is succeeded by another, well known by the name of *urinous smell*.

Its properties.

1. Urine reddens paper stained with turnsole and with the juice of radishes, and therefore contains an acid. This acid has been generally considered as the phosphoric; but Thenard has shown that it is in reality the acetic.

2. If a solution of ammonia be poured into fresh urine, a white powder precipitates, which has the properties of phosphate of lime.

3. If the phosphate of lime precipitated from urine be examined, a little magnesia will be found mixed with it. Fourcroy and Vauquelin have ascertained, that this is owing to a little phosphate of magnesia which urine contains, and which is decomposed by the alkali of lime employed to precipitate the phosphate of lime.

4. Proust informs us, that carbonic acid exists in urine, and that its separation occasions the froth which appears during the evaporation of urine.

5. Proust has observed, that urine kept in new casks deposites small crystals, which effloresce in the air and fall to powder. These crystals possess the properties of the carbonate of lime.

6. When fresh urine cools, it often lets fall a brick-coloured precipitate, which Scheele first ascertained to be crystals of uric acid. All urine contains this acid, even when no sensible precipitate appears when it cools.

7. During intermitting fevers, and especially during diseases of the liver, a copious sediment of a brick-red colour is deposited from urine. This sediment contains the rosacic acid of Proust.

8. If fresh urine be evaporated to the consistence of a syrup, and muriatic acid be then poured into it, a precipitate appears, which possesses the properties of benzoic acid.

9. When an infusion of tannin is dropt into urine, a white precipitate appears, having the properties of the combination of tannin and albumen or gelatine. Their quantity in healthy urine is very small, often indeed not sensible. Cruickshanks found that the precipitate afforded by tannin in healthy urine amounted to $\frac{1}{140}$th part of the weight of the urine.

10. If urine be evaporated by a slow fire to the consistence of a thick syrup, it assumes a deep brown colour, and exhales a fetid ammoniacal odour. When allowed to cool, it concretes into a mass of crystals, composed of all the component parts of urine. If four times its weight of alcohol be poured into this mass, at intervals, and a slight heat be applied, the greatest part of it is dissolved. The alcohol which has acquired a brown colour, is to be decanted off, and distilled in a retort in a sand heat, till the mixture has boiled for some time, and acquired the consistence of a syrup. By this time the whole of the alcohol has passed off, and the matter, on cooling, crystallizes in quadrangular plates which intersect each other. This substance is *urea*, which composes $\frac{8}{10}$ths of the urine, provided the watery part be excluded. To this substance the taste and smell of urine are owing. It is a substance which characterises urine, and constitutes it what it is, and to which the greater part of the very singular phenomena of urine are to be ascribed.

11. According to Fourcroy and Vauquelin, the colour of urine depends upon the urea: the greater the proportion of urea, the deeper the colour. But Proust has detected a resinous matter in urine similar to the resin of bile; and to this substance he ascribes the colour of urine.

12. If urine be slowly evaporated to the consistence of a syrup, a number of crystals make their appearance on its surface; these possess the properties of the muriate of soda.

13. The saline residuum which remains after the separation of urea from crystallized urine by means of alcohol, has been long known by the names of *fusible salt of urine* and *microcosmic salt*.

When these salts are examined, they are found to have the properties of phosphates. The rhomboidal prisms consist of phosphate of ammonia united to a little phosphate of soda; the rectangular tables, on the contrary, are phosphate of soda, united to a small quantity of phosphate of ammonia. Urine, then, contains phosphate of soda and phosphate of ammonia.

14. When urine is cautiously evaporated, a few cubic crystals are often deposited among the other salts; these crystals have the properties of muriate of ammonia.

15. When urine is boiled in a silver bason, it blackens the bason; and if the quantity of urine be large, small crusts of sulphuret of silver may be detached. Hence we see that urine contains sulphur.

Composition.

Urine, then, contains the following substances:

1. Water.
2. Acetic acid.
3. Phosphate of lime.
4. Phosphate of magnesia.
5. Carbonic acid.
6. Carbonate of lime.
7. Uric acid.
8. Rosacic acid.
9. Benzoic acid.
10. Albumen.
11. Urea.
12. Resin.
13. Muriate of soda.
14. Phosphate of soda.
15. Phosphate of ammonia.
16. Muriate of ammonia.
17. Sulphur.

These are the only substances which are constantly found in healthy urine; but it contains also occasionally other substances. Very often muriate of potash may be distinguished among the crystals which form during its evaporation. The presence of this salt may always be detected by dropping cautiously some tartaric acid into urine. If it contains muriate of potash, there will precipitate a little tartar, which may be easily recognized by its properties.

Urine sometimes also contains sulphate of soda, and even sulphate of lime. The presence of these salts may be ascertained by pouring into urine a solution of muriate of barytes; a copious white precipitate appears, consisting of the barytes combined with phosphoric acid, and with sulphuric acid, if any be present. This precipitate must be treated with a sufficient quantity of muriatic acid. The phosphate of barytes is dissolved, but the sulphate of barytes remains unaltered.

SECT. XXII. *Of Morbid Concretions.*

Morbid concretions.

Hard substances occasionally make their appearance in different parts of the animal body, both in the solids and the cavities destined to contain the fluids. In the first case they are denominated *concretions* or *ossifications*; in the second *calculi*. Their formation is an irregularity in the animal œconomy, and they often produce the most excruciating diseases. They may be divided into five classes; namely, 1. Ossifications; 2. Intestinal concretions; 3. Biliary calculi; 4. Urinary calculi; 5. Gouty calculi.

1. *Ossifications.*

Ossifications.

Under this name may be comprehended all the concretions which make their appearance in the solid parts of the animal body. The following are the most remarkable of these:

1. Small concretions sometimes form in the pineal gland. They consist of phosphate of lime.

2. Small concretions sometimes form in the salivary glands. These likewise consist of phosphate of lime.

3. Pulmonary concretions are occasionally coughed up by consumptive patients. They consist sometimes of phosphate of lime, sometimes of carbonate of lime, and sometimes of a mixture of both.

4. Hepatic concretions are composed of phosphate of lime, and a tough animal membrane.

5. The concretions which sometimes form in the prostate-gland are composed of phosphate of lime.

2. *Intestinal Concretions.*

Intestinal concretions.

Concretions sometimes form in the stomach and intestines chiefly of the inferior animals. Some of these have been celebrated under the name of *bezoars* for their medical virtue. A great many of them have been analyzed, and no fewer than eight species have been ascertained.

The first species consist of concretions composed of superphosphate of lime, the second of phosphate of magnesia, the third of ammonio-phosphate of magnesia; the fourth of the yellow matter of bile; the fifth of a green-coloured resinous matter; the sixth of small fragments of the *boletus igniarius*; the seventh of balls of hair felted together; and the eighth of woody fibre.

3. *Biliary Calculi.*

Biliary calculi.

Hard bodies sometimes form in the gall bladder and gall ducts, and occasion painful diseases. Four kinds of these calculi have been distinguished; the first kind is composed of a matter resembling spermaceti in appearance, soluble in hot alcohol, and crystallizing as the alcohol cools. This matter has been called *adipocire*. The second kind are angular, because a number of them exist in the gall bladder together. They are composed of adipocire, with a thin external crust of yellow matter of bile. The third kind are of a brown colour, and are supposed to be composed of the altered yellow matter of bile. The gall stones of oxen usually are of this kind. The fourth kind does not flame, but gradually waste away at a red heat.

4. *Urinary Calculi.*

Urinary calculi.

It is well known that concretions not unfrequently form in the urinary bladder, and occasion one of the most dismal diseases to which the human species is liable. These bodies have been carefully and repeatedly examined by modern chemists, who have found them to be very various in their composition. No less than nine distinct substances have been found. These being mixed in different proportions, occasion great variation in the composition of the calculi. The following are the substances:

1. Uric acid.
2. Phosphate of lime.
3. Phosphate of magnesia-and-ammonia.
4. Oxalate of lime.
5. Muriate of ammonia.
6. Magnesia.
7. Phosphate of iron.
8. Silica.
9. Urea.

The four first of these constitute by far the most common and abundant ingredients of urinary calculi.

5. *Gouty Concretions.*

Gouty concretions.

It is well known that concretions occasionally make their appearance in joints long subject to the gout. These concretions, from their colour and softness, are usually distinguished by the name of chalk-stones. They are usually small, though they have been observed of the size of an egg. All of them hitherto examined have been found composed of uric acid and soda, so that they consist of the salt called urate of soda.

PART III.

ON CHEMICAL APPARATUS.

Chemical Apparatus.

HAVING in the preceding part of the article given a pretty full outline of the present state of chemical science, it still remains for us to make our readers acquainted with the nature of the apparatus employed by chemists, and with the manner of conducting chemical experiments. We must warn our readers, however, not to be led away by the too common notion, that an expensive chemical apparatus is indispensible for making any progress in chemical investigations. By far the most eminent chemist who has ever appeared, we mean Scheele, conducted his researches, and completed his discoveries, with a very slender apparatus indeed. The same remark applies to Dr Priestley. And Mr Dalton, one of the most ingenious of the chemical philosophers at present in Britain, has conducted all his acute researches, and made all his important discoveries, with an apparatus so slender as to astonish every person who has seen it, and is acquainted with the numerous and important discoveries made by this celebrated philosopher.

That we may give some interest to this part of our subject, which is naturally dry and disagreeable, though of essential importance, we shall suppose ourselves giving directions to a young student, who wishes to make a complete set of experiments on every branch of chemical science. Now there are four distinct departments in chemistry, which require each a peculiar apparatus, and which must therefore be described separately. These are *heat*, *gaseous bodies*, *liquids*, and *solids*.

CHAP. I.

Apparatus for Experimenting on Heat.

Apparatus for experimenting on heat.

1. THE first and most essential instrument for experimenting on heat, is the *thermometer*, an instrument which, by the expansion of a liquid confined in a glass tube, indicates the temperature of any substance to which it is

applied. For an account of the construction of different kinds of thermometers, we refer to the article THERMOMETER.

Fahrenheit's thermometer.

Fahrenheit's thermometer is the one commonly used in this country. The freezing point on it is marked 32°, the point of boiling water is marked 212°, so that in this thermometer the interval between freezing and boiling water is divided into 180 degrees. The practical chemist ought to be provided with a variety of thermometers; some graduated as high as the boiling point of mercury, others as low as the freezing point of that metal. He should be even provided with a spirit of wine thermometer, graduated as low as 100°. If he is engaged in making experiments on the capacity of bodies for heat, he ought to have thermometers so delicate as to point out very minute changes of temperature. Dr Crawford had a thermometer in which every one of the usual degrees was divided into 50 parts, so that he could measure, with tolerable precision, the hundredth part of a degree of Fahrenheit's thermometer. It was with this very delicate instrument that he determined the specific heat of the gaseous bodies.

Leslie's differential thermometer.

The differential thermometer, invented by Mr Leslie, is an instrument of considerable value in ascertaining minute changes in temperature confined to a particular spot, when our object is not to determine the variation of the temperature of the room in which we are, but the peculiar variation in any point, independent of the general variation. It consists of two equal glass balls joined together by a glass tube bent somewhat in the form of a U. The tube is filled with a coloured liquid. If one of the glass balls be placed in a position hotter than that in which the other ball is placed, the air within it expands and presses down the liquid in the end of the tube nearest it. A scale of degrees is attached to this leg of the tube, by which the heat that the ball experiences is indicated. See the thermometer represented in Plate CXLI. Fig. 1.

Plate CXLI. Fig. 1.

Mortimer's pyrometer.

Various thermometers, or *pyrometers* as they have been called, have been contrived to measure high degrees of heat, as the fusing points of the metals, to most of which a common thermometer cannot be applied. One of the first of these was contrived by Dr Cromwell Mortimer. It consisted of a rod of steel or brass, which, by its expansion, moved a lever turning upon an axis, and pointing out the various degrees upon a plate. Though this instrument is not susceptible of much accuracy, yet as Dr Mortimer employed it to determine the fusing point of tin, lead, zinc, and antimony, and as the degrees which he pointed out are still to be found in modern chemical books, though seldom any reference is made to the original experimenter, we shall give a description and figure of his pyrometer in this place. In Figure 2. AB is a round rod of steel or brass, a quarter of an inch thick and three feet one inch long. When the rod is of brass three feet long, the point A must be of steel one inch long, to prevent its wearing away or losing its point, which conical point is made to screw on and off. CD, *cd* are two iron supporters, joined by a flat cross bar at bottom D*d*, two inches long, in the middle of which is a point $\frac{1}{8}$th of an inch high under B, which goes into a hole at the bottom of the rod B, and serves to keep the rod in its place at bottom; as the cross bar * *, having a hole in it through which the rod passes, does in the middle, or about two thirds up the supporters, and the point A goes into a small hole in the under side of the lever, all which keep the upright rod firm and steady in its place. The iron supporters are flat, or parallel to the front of the machine from C to X, and *c* to *x*, where they are twisted half round, so that the lower parts XD, *xd* stand at right angles with the upper parts. This contrivance gives the freer access to the rod for the sand or fluid into which the machine is set to measure its heat, the supporters standing two inches asunder at D*d*; and that the degrees of heat may be compared uniformly in different experiments, the bottom of the rod must always be immersed to the same height in the matter to be examined. On that account there is a mark made quite round the rod, $1\frac{1}{2}$ inch from the bottom B. For the deeper the rod is immersed into any matter, it will be lengthened the more by the same degree of heat. EF is the lever which turns upon the axis G. At F is fastened a string, which, passing twice round the pulley H, has a weight I hanging to the other end of it, of about $\frac{1}{2}$lb. being enough to keep the string always stretched. At the other end E of the lever is hung another weight L, which must be heavy enough, not only to counterbalance the larger arm GF, but press down on the point A with a weight sufficient to keep it steady. MNO is the back part of the plate, like the dial plate of a clock made of brass, the front of it being as in Figure 3. The pulley H turns on an axis C, in Figure 3, which goes through the plate, and on the other side or front of the dial-plate carries a hand or index AB.

Plate CXLI. Fig. 2.

Plate CXLI. Fig. 3.

Iron being a metal very ill adapted for frequent exposure to heat, in consequence of its great incombustibility, Guyton Morveau has lately proposed to substitute a rod of platinum instead of iron. We do not consider it as worth while to give a particular account of his instrument; but the reader who is inquisitive upon the subject, will find it described in the *Annales de Chimie*, vol. xlvi. p. 276.

Wedgewood's pyrometer.

But the most ingenious, and the best and most convenient method hitherto thought of for measuring high degrees of heat, was contrived by Mr Wedgewood, and the apparatus is well known by the name of *Wedgewood's pyrometer*. It consists of small cylindrical pieces of porcelain clay, carefully made of a determinate size, and baked in a low red heat. He employed for the purpose a particular bed of Cornish clay. This clay was first diffused through water, and the liquid passed through fine lawn. The clay was then suffered to subside and to dry. It is mixed with about $\frac{2}{7}$ths of its weight of water, kneaded into a paste, and formed into small pieces, in little moulds of metal, $\frac{6}{10}$ths of an inch in breadth, with the sides pretty exactly parallel; $\frac{4}{10}$ths of an inch in depth, and 1 inch long. These pieces, when perfectly dry, are put into another iron mould or gage, consisting only of a bottom with two sides, half an inch deep, to the dimensions of which sides the breadth of the pieces is to be paired down. The constituents of the clay employed, according to Mr Wedgewood's analysis, are $\frac{2}{5}$ths alumina, and $\frac{3}{5}$ths silica.

It is the property of clay pieces, after having been baked in a red heat, to shrink permanently in their dimensions, according to the degree of heat to which they have been exposed. This diminution of bulk is the principle of Wedgewood's pyrometer. For measuring the diminution which these pieces undergo when exposed to heat, a gage is made of two pieces of brass, 24 inches long, with the sides exactly straight, divided into inches and tenths, fixed half an inch asunder at one end, and $\frac{3}{10}$ths at the other, on a brass plate; so that one of the clay pieces, when pared down in the iron gage, will just fit the wide end. This gage is divided into 240 degrees, each of which, of course, is one tenth of an inch distant from the succeeding one. The wide extremity of the gage is marked 0, and the degree at the narrow extremity is marked 240°. Let us suppose a clay piece to

Chemical Apparatus.

be exposed for a few minutes to the heat of a furnace, and to have been diminished in bulk by the heat one-fifth part. It is obvious, that when applied to the gage, it will slide up just one half of the whole, and will stop over against the degree marked 120°, indicating the heat of the furnace to have been 120°.

Wedgewood, by a very ingenious set of experiments, contrived to connect his pyrometer scale with that of Fahrenheit. He found that 0, on his scale, corresponded to $1077\frac{1}{2}$° of Fahrenheit, and that every degree of his pyrometer is equal to 130° of Fahrenheit. Hence, 240° Wedgewood, or the extremity of the scale, corresponds with 32277° of Fahrenheit. For the description of his pyrometer, and the experimental investigations by Wedgewood himself, the reader is referred to the *Philosophical Transactions*, 1782, vol. lxxii. p. 305; and 1784, vol. lxxiv. p. 358. Objections have been made to the accuracy of Wedgewood's pyrometer, from various quarters; but none of the objections which we have seen are warranted by accurate experiments.

2. Some very accurate instruments for ascertaining the expansion of solid bodies by heat, have been invented by Ellicott, Smeaton, and Ramsden. For an account of these, we refer the reader to the *Philosophical Transactions*, 1736, vol. xxxix. p. 297; and 1751, vol. xlvii. p. 479; and 1754, vol. xlviii. p. 598.

3. For containing freezing mixtures, it is best to employ a double vessel of tin-plate, which, in consequence of the confined stratum of air, prevents the external atmosphere from acting so speedily on the mixture, and destroying its efficacy. Several convenient enough vessels for such purposes have been figured and described by Mr Walker, in the *Philosophical Transactions* for 1795, vol. lxxxv. p. 270.

4. For ascertaining the specific heat of bodies, or the capacity of bodies for heat, a very simple method was employed by Meyer. And from the subsequent experiments of Leslie and Dalton, there is reason to believe that the method is accurate. He took equal bulks of the bodies whose specific heats he wanted to know, heated each to a given temperature, and then allowed them to cool a given number of degrees. The time of cooling in seconds multiplied into the specific gravity of each body gave its specific heat. When liquids are the subjects of experiment, they must of course be confined in a vessel. The specific heat of this vessel must be previously determined, and the effect which it has upon the rate of cooling of the liquid must be attended to, otherwise the results obtained will be inaccurate.

The apparatus employed to ascertain the specific heat of bodies by mixture, by Black, Wilke, Crawford, &c. requires no description. But there are two pieces of apparatus connected with this subject, of so complicated a nature, that they will require to be particularly noticed. The first of these is the apparatus contrived by Crawford, for determining the specific heat of gaseous bodies: The second is the instrument invented by Lavoisier and La Place, for ascertaining the specific heat of bodies, by the quantity of ice which they are capable of melting. To this instrument they gave the name of *calorimeter*.

Plate CXLI. Fig. 4.

Crawford's apparatus for determining the specific heat of the gases.

Dr Crawford's very delicate apparatus for determining the specific heat of the gases, was the following: AB, CD, Fig. 4. represent two slight brass cylindrical vessels, of equal weights and capacities; the weight of each was 7 ounces, 3 drachms, and 38 grains, troy; the length, $8\frac{7}{8}$ inches; the breadth, $2\frac{1}{4}$ inches near the upper extremity, and $2\frac{1}{8}$ inches near the bottom. They were each capable of containing 20 ounces troy of water; and, consequently, the solid contents of each is 37.91 cubic inches. These cylinders terminate in the small tubes *ls*, *rk*, at the extremities of which are fixed the brass cocks *s* and *k*. These cocks are joined to the cross bar MN, which consists of two elastic brass plates that are screwed together at the middle, but are capable of being separated from each other to a little distance at their extremities; in consequence of which, the necks of the cocks that are fixed to the stems of the brass vessels, can be slipped in between them, where they are lodged in grooves formed for receiving them, and are made fast by small screws that pass through the extremities of the plates. To the middle of the cross bar is fixed a square socket, the inner surface of which is finely polished, and which is of such a size as to be accurately adapted to the polished upright bar EF, and at the same time easily moveable upon it. At equal distances from the upright bar, are placed the tinned vessels, GH, IK, that have a little more than double the capacity of the brass cylinders. The distance of these vessels from the upright bar are so adjusted, that when the cylinders are made to descend, they shall be directed by the bar and socket precisely into the centres of the tinned vessels; and when, in descending, they have arrived at one-eighth of an inch from the bottoms of those vessels, they are stopped by means of a pin fixed in the upright bar at the point *d*. The cylinders being made for the purpose of receiving the gases whose specific heats were to be ascertained, were made as slight as was consistent with standing the external pressure of the atmosphere when exhausted. With a view to diminish the inaccuracy unavoidably occasioned by the heats communicated by the cocks *s* and *k*, and by the cross bar MN, the tubes *ls*, *rk*, were made very slight, and of a considerable length; the distance from the cocks to the brass cylinders being $4\frac{7}{8}$ inches. From the length and slightness of the tubes, it was found that the brass cylinders could not be kept sufficiently steady in the centres of the tinned vessels by the cross bar MN. For this reason, another bar, OP, was added, a lateral view of which is given in Fig. 5. In this figure, *ab* represents a narrow brass plate, of a considerable thickness, to which is fixed the socket *op*, moveable upon the upright bar formerly described. The two thin plates *cn*, *dk*, are riveted to *ab*, at the points *o* and *p*; and their extremities, *l* and *m*, are formed into grooves, which are adapted to one half of the circumference of the stems of the brass cylinders, to the other half of which are closely applied two brass pieces, which are also grooved, and which are fastened to the plates by the screws *r* and *s*. The two male screws, *g* and *h*, are passed through the extremities of the thick plate *ab*. These are introduced into two corresponding female screws, in the thin plates *cn*, *dk*, by means of which it is evident, that the latter may be made to approach nearer to the former, or to recede to a greater distance from it. This motion is communicated to the stems of the brass cylinders, by means of which they are adjusted in such a manner, as that when they are introduced into the water, they shall be accurately in the centres of the tinned vessels, where they are kept steadily in their proper positions. The superior and inferior cross bars are connected together by a thin plate of brass,

Fig. 5.

which passes from the socket of the former to that of the latter, and which is made fast by means of screws. The screw that fixes this plate to the socket of the inferior bar, is of such a length, as when screwed home, to extend to a small distance beyond its inner surface, by which means the apparatus, in descending along the upright bar, may be fastened to any part of it.

Plate CXLI. Fig. 4.

To each of the tinned vessels (see Fig. 4.) two very small mercurial thermometers are fixed, which are of different lengths; the larger reaching as far as the centre of the vessel; the shorter extending a little lower than the surface. The thermometers *a b* and *c d*, which indicate the heat in the vessel GH, are applied to a thin plate of ivory *e f*, which has two scales divided upon it, one for each thermometer. This plate is fixed to the vessel by means of a clamp *g h*, the shank of which consists of two thin elastic brass plates, united at the top, and separable from each other at the lower extremity. For the purpose of admitting the thermometers, the projecting part *o v*, having the figure of a parallelopiped, was added to the tinned vessel. The exterior side of this projection is received between the plates of the shanks described above. These plates are closely applied to it, by means of their elasticity, in consequence of which the clamp is steadily retained in its position, at the same time that it admits of a considerable degree of elevation or depression. Hence the depth to which the thermometers are sunk may be varied at pleasure; and, in order that this depth may be accurately known, a scale of equal parts is divided upon the exterior plate of the shank. Through the upper part of the shank is passed a small male screw S, similar to that which is used in adjusting the focus of a telescope. This is introduced into a corresponding female screw, inserted in the ivory plate, which has the thermometers fixed to it; and as that plate is suspended in the clamp by a pin, around which it has a free motion, it is manifest, that, by turning the above mentioned screw, the thermometers may be made to approach nearer the centre of the vessel, or to recede farther from it.

The two brass cylinders in this instrument were intended to hold the gases experimented upon. The gas to be used was first introduced into a tin syringe, previously filled with water. To the end of this syringe was fixed a worm, terminating in a flaccid bladder. The worm was surrounded by a mixture of salt and ice. The gas was slowly forced through this worm from the syringe, and extended the flaccid bladder. The object of this was to free the gas as much as possible from moisture, by exposing it to the cold of the freezing mixture. The brass cylinders being previously exhausted by means of an air pump, the bladder was screwed to the top of the stem, and the stop-cocks being opened, the gas rushed in and filled the cylinder.

Fig. 6.

The next object was to heat the cylinder containing the gases equally, and without moistening them. Dr Crawford's contrivance for that was the following: AB (Fig. 6.) represents a quadrangular tinned vessel, that has the two smaller vessels, CD, EF, fixed to its bottom by means of dovetails, along which they may be made to slide, and may be so adjusted, that their distances from each other shall be equal to the distances of the cylindrical vessels in which the air is contained; their size being such, that they shall be nearly accurately filled by those vessels, when the latter are introduced into them. It is therefore manifest, that warm water contained in the large vessel AB, and coming into contact with the external surfaces of the smaller vessels CD, EF, will necessarily communicate a part of its heat to those vessels, and to the cylinders which are placed in them. If the cylinders had been heated by being immediately immersed in warm water, a quantity of moisture would have adhered to their sides, which would have produced an inaccuracy in the experiment. Two small thermometers, *l*, *r*, are introduced into the brass cylinders (Fig. 4.), in order to indicate the heat which the gas contained in them requires. Each of the brass cylinders is enveloped in flannel, in order to confine the heat as much as possible.

Plate CXLI. Fig. 4.

Such is the ingenious apparatus of Dr Crawford. It remains to say a few words upon the way in which his experiments were conducted. Suppose he wanted to determine the relative specific heats of common air and oxygen gas, he filled one of the cylinders with common air, and the other with oxygen gas. The cylinders were both heated equally by the contrivance exhibited in Fig. 6. They were then suddenly let down into the tinned vessels, IK, GH, (Fig. 4.) containing each an equal quantity of water of the same temperature. They were allowed to remain for about 15 minutes, and being withdrawn, the water in the tinned vessels was agitated for a little, and its temperature taken. As the weight and temperature of each brass cylinder and its flannel covering was the same, if there was any difference in the temperatures of the water in the two tinned vessels, that difference must have been owing to the heat communicated by the gas in the one cylinder being greater than the heat communicated by the gas in the other cylinder. Suppose, for example, that the water exposed to the action of the cylinder containing the oxygen gas, were one degree hotter than the water exposed to the action of the cylinder containing the common air; it follows from this, that 37.91 cubic inches of oxygen gas, when they cool a certain number of degrees, give 1° more heat to a certain weight of water, than the same bulk of common air. From the knowledge of this fact, the capacity of each for heat is easily inferred. Such was the ingenious method employed by Dr Crawford; and the care and address with which his experiments were conducted cannot be too highly praised. At the same time, we are afraid that his results are not near approximations to the truth; and that the unavoidable errors of experiment, when the whole difference between the temperatures amounts only to one or two tenths of a degree, are such, as to render every result obtained by his method of little value. Though the time which a body takes in cooling, when placed in the different gases, does not depend upon their capacity for heat alone, yet as that capacity influences the result, valuable inferences may be drawn from experiments made in that way; and they promise to lead ultimately to a much more precise knowledge of the capacity of the different gases for heat, than any other method which has been hitherto thought of.

Calorimeter.

The *calorimeter* is an instrument contrived by Lavoisier and La Place, for determining the specific heat of bodies, and was first described by them in the Memoirs of the French Academy for 1780, p. 355. Lavoisier afterwards re-published the account of it in his Elements of Chemistry, Part III. Chap. iii. It was founded upon this well known fact, that if a hot body be surrounded by a sphere of ice, none of the heat can penetrate through the ice, but will be all employed to melt it. Hence the quantity of ice melted ought to measure the quantity of heat which has escaped out of the hot body, and, of course, gives us the relative specific heats of all the bodies examined in this manner. The calorimeter is represented in Fig. 7. It consists of three vessels enclosed within each other. The innermost of these, *ffff*, into which the substance submitted to experiment is put, is composed of a grating, or cage of iron wire, supported by several iron-bars. Its opening, or mouth, is covered by a lid, which is composed of the same materials. The middle cavity, *bbbb*, is intended to contain the ice which surrounds the interior cavity, and which is intended to be melted by the heat of the substances employed in the experiment. The ice supported by the grate, *mm*, at the bottom of the cavity, has under it a sieve. In proportion as the ice contained in the middle cavity is melted by the heat disengaged from the body placed in the interior cavity, the water runs through the grate and sieve, and falls through a conical funnel into a receiver placed below it. The external cavity, *aaaa*, is filled with ice, to prevent any effect upon the ice in the middle cavity from the heat of the surrounding air; and the water produced from it is carried off by the pipe ST, which shuts by means of the stopcock *r*. The whole machine is covered with a lid, made of tin-plate and painted.

Plate CXLI. Fig. 7.

When this machine is to be used, the outer and middle divisions are filled with pounded ice, well rammed, and without any vacuity. The machine is then opened, and the substance, submitted to experiment, being placed in the interior cavity, it is instantly closed. After waiting till the body is cooled down to the freezing point, the water which has run out from the middle cavity is carefully weighed. This water obviously measures the quantity of heat which has escaped from the body experimented upon, during its cooling to the freezing point. For the various precautions employed by the French philosophers, during their experiments with this apparatus, to ensure accuracy, the reader may consult Mr Lavoisier's account of them in his Elements of Chemistry, to which we have referred above. The only person in this country, who has attempted to repeat the experiments of Lavoisier and La Place, was the late Mr Wedgewood. In his trials a phenomenon took place, which prevented him from being able to draw any conclusions from his trials. The water which ran from the melted ice actually froze again, though the temperature of the ice was at 32°. Such a phenomenon, unless it can be obviated, obviously makes the calorimeter, ingenious as the contrivance at first sight appears, entirely useless as an instrument for investigating the specific heat of bodies. The freezing of the water seems to be owing to the cold produced by its evaporation. From Mr Wilson's experiments, it appears that the evaporation of ice is greatest, when its heat is 32°. Now, as the temperature of the water, produced by the melting of the ice in the calorimeter, cannot much exceed 32°, it is obvious that a very slight diminution of temperature by evaporation will be sufficient to begin congelation; and when congelation once begins, the attraction of the spiculæ of ice formed for the particles of water, will probably tend to increase the quantity of ice.

There are no other apparatus connected with heat, which seem to require particular description. The contrivances of Mr Leslie and of Count Rumford possess great ingenuity; but are so simple, that the reader can find no difficulty in understanding them.

Chap. II.

Apparatus for Experiments with Gases.

Apparatus for experiments with gases.

This branch of Chemistry requires by far the most expensive and complicated apparatus. We shall satisfy ourselves with describing the most important requisites. Almost every chemical experimenter has added something of his own to this department of chemical vessels. Hence it would be an endless and a useless task to describe every thing that has been proposed, or even brought into use.

Water troughs.

1. The first requisite is a water-trough, for preparing the gases, and for containing the vessels in which the gases are confined. These are of various sizes, according to the extent of the laboratory, or the objects which the proprietor has chiefly in view: the largest are made of wood and lined with lead, about four feet long, three wide, and two deep. They have a wooden shelf fixed about three inches under the surface, upon one side of the trough, for holding the glass jars. This shelf is perforated with holes, for the conveniency of pouring the gases from one jar to another; and these holes are usually funnel-shaped, having their wide mouth at the under side of the shelf. This trough, when to be used, is to be filled with clean water. Water-troughs are often made much smaller than this. In that case, they are only made of tin-plate and japanned; or what would be much better, and perhaps even ultimately cheaper, would be to make them of copper, which ought likewise to be japanned. A trough of this kind, two feet long, sixteen inches wide, and as much in depth, with a shelf soldered to one of its ends, also of copper, and placed about two inches under the surface, would answer a great variety of purposes, and, from its small size, would be convenient, as it could easily be carried from one place to another, even when full of water. We shall give a figure of the small tinned iron water-troughs that are commonly used in London. *a* (Fig. 8.) is a deep oblong trough, made of thin tinned iron, well japanned, generally 18 inches long, 9 broad, and 14 deep. About 3½ inches from the top is a shelf of the same material, extending entirely across the trough, and rather more than a third of its length. This shelf is given inverted in Fig. 9. to show an oval rim projecting from it in the centre, of which are two small holes, the use of which is to secure and convey the gas into any vessel set upon it, (as the bottle Fig. 8.) This shelf has also two larger holes to receive two bottle supporters. Fig. 10. and *b*, Fig. 8.

Plate CXLI. Fig. 8.

Fig. 9.

Fig. 10.

2. To prepare the gases, various vessels may be employed, according to the nature of the gas wanted. Small retorts, with long beaks, (see Fig. 11. and 12.) answer very well; or flasks, with bent tubes ground into them. (See Fig. 13, 14, and 15.)

Fig. 11, 12, 13, 14, 15.

3. To receive the gases as they come over, the most simple apparatus consists of glass phials, with ground stoppers, made perfectly air tight. These may be filled one after another, and, the stoppers being fitted in, may be placed with their mouths inverted in a vessel of water, and kept till wanted; or glass jars may be employ-

ed, open below and shut above, as those represented in Fig. 16 17. Plate CXLI.; and in Fig. 1. Plate CXLII.

Plate CXLI. Fig. 16, 17.

Gazometers.

4. When the quantity of gas prepared is considerable, it is necessary to be provided with larger vessels than any of those already mentioned to contain it. Such vessels are usually made of tin-plate japanned, or partly of tin-plate, partly of glass, and they are known by the name of *gazometers, gas holders*, air holders. Their construction is very various, according to the fancy of the chemist, or the object which he has in view. We shall give a description of some of the most useful.

Plate CXLII. Fig. 3, 4.

Fig. 3. and 4. represent the outline of a very convenient vessel for holding oxygen gas. It is made of tin-plate, well japanned, both withinside and without. It may be of any size: the vessel, of which this is a representation, held about 2000 cubic inches. It is a cylindrical vessel, close on all sides, and ought to be pretty strong to resist the pressure of the atmosphere, which tends to force out gas, or to force in air according to the changes in its density which take place. It is furnished with three mouths, A, B, C. The first at the top, the second at the side as high up as possible, the third at the bottom. A and B are each provided with a stop-cock. The stop-cock A is soldered into the tube D, which goes to the very bottom of the vessel to which it is soldered, in order to increase the strength of the air-holder. The tube D, towards its bottom, is perforated with a number of holes. To the extremity of the stop-cock B, the piece of bent tube E is ground, so as to be air-tight, but to move freely round the extremity of B, which is turned up to receive it. And to the extremity of E, the long tube F is likewise ground, so as to be air-tight, yet capable of moving freely. These two tubes, by their motion, form an universal joint, so as to enable the operator to turn the extremity of the tube F any way he thinks proper. The mouth C consists of a tube about an inch in diameter, introduced into the vessel, near the bottom, at an angle of about 45°. It is provided with a stopper, which screws into it and shuts it close. G is a glass tube, fixed into the top and bottom of the air-holder, and graduated. The use of it is to shew the operator how much gas the vessel contains. It is a large glass conical vessel, made to fit into the upper end of the stop-cock A.

A few words will explain the method of using this vessel. The first step is to fill it with water. For this, the mouth C must be shut, and the stop-cocks A and B opened. Water is then poured into the glass vessel H, which, running down the tube D, makes its escape through the holes in its bottom, and fills the vessel, while the common air makes its escape by the stop cock B. When the air-holder is quite full of water, the stop-cocks A and B are to be shut, the glass vessel H removed, and the stopper of the mouth C removed. As the vessel is completely air tight, the water cannot make its escape by the mouth C, because the angle at which it enters the vessel, prevents any common air from entering. The mouth of the tube connected with the apparatus for furnishing oxygen gas being introduced into C, the gas rises gradually to the top of the air-holder, and the water runs out by the mouth C. When the process is finished, the mouth C is to be shut; and if the vessel be a good one, the gas may be kept in it for many months without undergoing much alteration. Suppose we want a portion of the oxygen gas out of this air-holder, for any particular purpose, we have only to introduce the point of the tube F into the mouth of the vessel which we mean to contain the oxygen gas, and then to pour a quantity of water into the glass vessel H, which must be replaced for the purpose. The stop-cocks A and B being opened, the water runs down the tube D, and forces the oxygen gas to escape through the tube F. By this method any quantity of the gas wanted may be easily procured.

Plate CXLII. Fig. 3, 4.

Another gazometer, of a different construction, is represented in Fig. 3, 4. which are merely different views of the same vessel, and the same letters in both refer to the same parts. Like the former, it is made of tin-plate, well japanned, both within and without. *aa* is the outer pail, or circular vessel, with a spout at top. Two tubes, *d* and *e*, (each filled with a stop-cock externally), are firmly soldered to the sides of the pail: the tube *d* penetrates at the bottom of the pail, and proceeds to the centre, where it joins the termination of the tube *e*, which enters the top of the pail, and proceeds downwards; and from the place of junction, the upright tube *g* rises through the middle of the pail, a little above the level of its upper rim. The vessel *b* is a cylinder, open only at bottom, and of less diameter than the pail into which it is inverted, and can move up and down freely. This cylinder has a solid stem, *c*, which passes through a hole in the wooden cross bar of the frame, round the top of the pail, and serves both to keep the cylinder in a perpendicular direction when moving up and down, and to indicate the quantity of inclosed gas by the graduation on its surface. The weight of the cylinder is counterpoised by weights put into a scale dish, which is connected with the top of the cylinder by a cord and pulley. The pail has besides an opening through its bottom, closed by a separate stop-cock, *f*, by which the water may be drawn off. The whole apparatus is conveniently supported on a heavy wooden stool. To use this gasholder, first let the cylinder fall to the bottom of the pail, and pour water into the spout of the latter till it is quite full; then shut the cock *e*, and open *d*, and connect with it the tube which conveys the gas immediately from the retort or other vessel in which it is produced: or, if more convenient, shut *d*, and convey the gas through *e*. The gas rises through the upright tube *g*, to the top of the cylinder *b*, which it gradually lifts up; and care must be taken to keep in the scale-dish sufficient weight to allow the cylinder to move with perfect freedom. When all the gas wanted is obtained, shut the stop-cock, and it remains in the air-holder till wanted. To take out any of it, connect with either of the stop-cocks a bent tube, and insert the mouth of it into a vessel destined to receive the gas, remove the weights out of the scale-dish, and open the stop-cock. The weight of the cylinder *b* will press out the gas and fill the vessel.

As the weight of the cylinder is constantly increasing during the whole of its rise out of the water, it is necessary to be continually adding weights to the scale-dish to compensate for this increase, otherwise the gas will be more and more compressed, and at last will cease to enter altogether. Or this increase may be still better compensated, by making the cord pass over a spiral pulley, by means of which, the weight in the scale-dish will act more and more powerfully as the cylinder rises, and thus compensate the increase of its weight.

Many other gas holders have been contrived by chemists; but it is needless to describe them, as they may be essentially referred either to one or other of the two which we have figured.

5. Many gases are absorbed with such avidity by water, that it is necessary to prepare them over mercury. Hence a mercurial trough is also requisite for all those who wish to investigate the properties of gaseous bodies with any thing like success. Mercurial troughs are very various in their shapes. One of the most usual and best shapes is represented in Fig. 5. It may be made of mahogany, or it may be cut out in marble; or what is now most common, it may be of iron, and covered externally with wood. *a* is the cistern filled with mercury, in which the glass jars are to be filled, and then slid upon the shelf visible in the Figure. The glass jars used with this trough must be smaller than those used for the water trough, and they ought to be stout. As they are liable to be overturned by the weight of the mercury, care must be taken to fix them.

Mercurial troughs.

Plate CXLII. Fig. 5.

Mercurial gas-holders are used, made on a similar plan with the second kind of gas-holders described above. The outer case is cast iron. There is an inner cylinder of cast-iron, at a little distance within the interval between them, filled with mercury; *v*, a glass jar, is made to move freely between both, and to receive the gas. The reader will easily conceive a gas-holder of this kind without a figure.

Method of measuring the bulk of gases.

6. It is necessary to be in possession of a method of measuring the bulk of our gases with accuracy. For this purpose, the jars into which they are received should be accurately graduated. The best graduation is into cubic inches, and their decimal parts. The experimenter should perform this graduation himself, otherwise he can very seldom depend upon its accuracy. He should first provide himself with some glass tubes, shut at one end and open at the other, and of as equal a bore as possible. Some of them should be $\frac{1}{4}$th inch in width, others $\frac{1}{8}$th, and some may be as wide as $\frac{5}{8}$ths, or even $\frac{3}{4}$ths of an inch. A long ribbon of white paper, about $\frac{1}{5}$th inch wide, should be pasted along the whole length of the tube by means of gum water. That it may adhere to the glass in every part, a quantity of twine may be wrapt round it while wet, and the tube may be set aside till next day, when the paper will be found adhering to it closely in every part. The tube is now set in an exact perpendicular direction with its open mouth uppermost. We shall suppose it our intention to graduate this tube into hundred parts of a cubic inch. The best method of doing this is the following:

Provide a quantity of mercury, and ascertain its specific gravity with accuracy. This being known, it is easy to ascertain the weight of $\frac{1}{100}$th cubic inch of mercury. For example, the mercury which we are in the habit of using is of such specific gravity, that $\frac{1}{100}$ of a cubic inch weighs 34.46 grains. Weigh out this quantity of mercury, and introduce it into a tube terminating in a point, and of a bore as narrow as possible, but still allowing the mercury to run out freely. The mercury should occupy about 3 inches in length of it from the pointed end. Mark carefully with a file the part of the tube to which the mercury rises. This tube, thus prepared with a pair of good scales, will enable you to graduate your tube with considerable rapidity. Pour the first $\frac{1}{100}$ cubic inch of mercury into your tube, observe its surface, and draw a fine line with a pencil upon the ribbon of paper over against this surface. Draw up into your pointed tube, by means of the mouth, a quantity of mercury, till it just rises to the mark. Put this quantity into your scales, and, if you manage matters with tolerable dexterity, you will find that it will weigh exactly 34.46 grains. Pour this into your tube, and draw a pencil line over against its surface. Proceed in this way till you have filled your tube to the top. By this method, you have got your tube graduated upon the ribbon of paper. To graduate it upon the tube itself, which is requisite, procure some small triangular files, and moistening one of the angles, draw it along the pencil marks upon the paper. You soon cut through the paper, and make an impression upon the glass tube; and, if you manage matters with address, you do not injure the adhesion of the rest of the paper to the tube. At every 5th degree, make the line upon the tube somewhat longer than the preceding 4 lines; and make the line still longer at every 10th degree. Having thus marked the degrees upon the whole length of the tube, dip it into water, and wash off the paper. If you have used the file properly, you will now find the lines engraven upon the tube very neatly and distinctly. You now with a diamond write the numbers 10, 20, 30, &c. opposite to the respective lines upon the tube.

Large jars are to be graduated in the same manner, only you divide them into cubic inches instead of $\frac{1}{100}$th of cubic inches. It is necessary also to use water instead of mercury. As a portion of the water adheres to the vessel in which you weigh it, you must make an allowance for this quantity, otherwise your marks will represent something less than cubic inches. This error, though small, becomes extremely sensible after being repeated one, two, or three hundred times.

7. Suppose it required to take a small quantity of gas out of a jar standing over water, and introduce it into a vessel standing on the mercurial trough, without taking any of the water along with it, or even wetting the inside of the vessel. This may be done by a very simple instrument, first contrived by Mr Cavendish, and represented in Fig. 6. It consists of a glass tube, graduated into $\frac{1}{100}$ths of a cubic inch, open at both ends: One end, however, drawn out to a capillary tube. This tube being first filled with mercury, is to be introduced into the jar standing on the water trough, with the finger shutting up closely the end A, which must be undermost. When fairly within the jar, you withdraw the finger a little from one side of A, and let the mercury run out, till its upper extremity comes opposite to the degree, marking the quantity of gas which you want to take out. The finger immediately resumes its place. By this contrivance, the gas is made to enter at the capillary end B, and to fill what part of the tube you have a mind. You then withdraw the tube from the water trough, holding your finger in its position all the while, and wipe the outside of the tube dry with a cloth. You then carry it to the mercurial trough, place the point B under the jar or tube into which you wish to introduce the gas, and bending the tube so, that the whole of A is under the surface of the mercury, and the end A somewhat lower than the end B; remove your finger from A, the mercury runs in, and the gas makes its escape from the capillary end B, and enters into the vessel prepared for its reception.

Plate CXLII. Fig. 6.

Method of measuring the specific gravities of gases.

8. The next object after being able to measure the bulk of gases, is to ascertain their specific gravity. To do this, it is necessary to be provided with a good air pump, or at least with an exhausting syringe. Very ex-

tensive apparatus were contrived by Lavoisier and others for weighing gases; but they are unnecessary, and do not even answer so well as a much more simple and cheap contrivance which we shall now explain. Let a Florence flask, or one of those thin glass flasks that come to this country from Italy filled with oil, be well cleaned, and fitted with a cap and brass stop cock, both as light as possible. This flask, by means of an intermediate short brass tube properly furnished with screws, is made to fit to a jar standing over water, and furnished with a stop cock at the upper end, and to another jar of the same construction standing in the mercurial trough. Suppose we want to take the specific gravity of a gas standing over water. We first weigh the flask and stop-cock with as much accuracy as possible. We then exhaust it of air and weigh it again, noting the loss of weight, which indicates the quantity of air drawn out of the flask. Let us suppose this loss of weight to amount to 10 grains. We now screw the flask to the jar containing the gas to be weighed, and turning the stop-cocks, the gas rushes in and fills the flask. We must take care that no water or mercury make its way into the flask along with the gas. This is best guarded against, by filling the intermediate brass tube with cotton. We now weigh the flask a third time. If its weight be the same as at first, then the gas is of the same specific gravity as common air; if it is lighter, the gas is lighter than common air; if it is heavier, the gas is heavier than common air. Suppose, for example, that the flask wants 5 grains of its original weight. We infer, that the weight of air is to the weight of our gas as 10 to 5, or that its specific gravity is one half of that of common air. By this easy method we determine the specific gravity of any gas, taking the specific gravity of air at 1.00; and knowing that at the temperature of 60, and when the barometer stands at 30 inches, 100 cubic inches of air weigh 30.5 grains, we can easily deduce from our experiments the absolute weight of our gas. No correction is necessary, either for temperature or for the height of the barometer, because all gases undergo the same change in bulk by heat and pressure.

Balance for specific gravities.

9. One essential requisite for taking the specific gravity of gases, is a good balance. The one which we employ was made by Mr Cuthbertson of Glasgow, and weighs easily to the hundredth part of a grain, so that we are sure of our specific gravities of gases to two decimal places, but no farther. As Mr Cuthbertson's beams differ in several particulars from any others that we have seen, we shall give a figure and short description of one of them, and mention some of its excellencies and defects. See Fig. 7.

Plate CXLII. Fig. 7.

The beam *ab* is made of cast steel; and, as will be seen by the Figure, is very slender, though of considerable length. To prevent it from warping or bending, the two slender wires *c*, *c* are riveted into the ends of the beam, and screwed tight to the upper end of the tongue of the balance. These wires, or *stays*, constitute the chief difference between this and other balances. There is nothing peculiar in the construction of the other parts. The sensibility is owing chiefly to the great length of the beam. The principal defect of this balance, is the way in which it is suspended to the top of the glass case by means of the hollow brass cylinder *d*. A solid cylinder of brass, attached to the top of the balance, plays in this hollow cylinder; and by means of the string *e*, and weight *f*, the balance is raised above the stand, or let down to it at pleasure. This mode of suspension gives such a tendency of shaking to the balance, that the process of weighing is very tedious.

Electrical machine.

10. Many of the gases are of an inflammable nature, and it is by their combustion with oxygen that the inferences are drawn with respect to their nature and constituents. The combustion of the gases requires a peculiar apparatus, which it will be requisite to describe. A good electrical machine is the first requisite. This may be either a plate machine, according to the more modern and fashionable construction, or a cylindrical one. All that is wanted is, that it should give out strong sparks when in proper order; for burning the gases, a very strong glass tube is used, about four inches long, and $\frac{3}{4}$ths inch wide, shut at one end, and open at the other. This tube is graduated, and should hold about three cubic inches. Two holes are drilled in it opposite to each other near the top, and into these are cemented two brass pins, which project into the tube, and approach near enough to transmit a spark from one to the other externally. These pins terminate in small rings. The mixture of gases being put into this tube, it is firmly fixed down in a water or mercurial trough by a strong iron screw. The brass pins being now connected with the electrical machine, a spark is made to pass from the one to the other, which sets the gas on fire.

When this experiment is made over mercury, the sudden expansion produced by the combustion of the gas, is apt to drive some of the mercury out of the trough. To remedy this inconvenience, the French chemists usually put a stop-cock at the bottom of their detonating tube, which they shut before passing the electric spark. But this is a bad method, as the shock is very apt to break the glass tube however strong, unless the quantity of gas burnt be very small. Mr Pepys has contrived the apparatus represented in Fig. 8, which answers very well. The detonating tube *a* is supported by a strong iron stand *c*, which has a strong spring near the foot, which draws out after the manner of a steelyard when the concussion is given. The inconvenience may be remedied also, by placing the detonating tube in a copper cylindrical vessel about 3 inches deep, and filled with mercury. The depth of the mercury prevents the concussion from being so violent, as to drive out and spill the mercury.

Plate CXLII. Fig. 8.

Henry's apparatus for the slow combustion of gases. Fig. 9.

11. It may be worth while to describe here an apparatus contrived by Dr Henry, for the slow combustion of inflammable gases. This apparatus is represented in Fig. 9. *aaa* is a pneumatic trough filled with water. *nn* a large glass jar likewise containing water. *cc* is a stand, to which the graduated air holder *b* is made fast, by means of the moveable arm *dd*. *oo* is another air-holder, fixed by the plugs *vv* into the glass jar *nn*. It is furnished with the stop cocks *q*, *r*, and the bent tube *s*, which passes into the water cistern, and passes up a certain way into the air-holder *b*, terminating in the iron burner *t*. The air-holder *b* is closed at top by a brass cap *e*, and stop-cock *f*, the lower orifice of which is tapped internally, for the purpose of receiving a small screw at the end of the copper wire *g*. The gas to be burnt is put into the air-holder *oo*, while the air-holder *b* is filled with oxygen gas. By opening the stop cocks *q*, *r*, and letting water run into the jar *nn*, the gas is gradually forced through the tube *ss* into the air-holder *b*. An electric spark sets it on fire at *t*, and it continues to burn till the oxygen or the inflammable gas

are wasted. The rapidity of the flow of water is regulated by the cocks *x*, *x*. The water makes its way into the air-holder by the holes *w*, *w*, drilled in the plate to which its bottom is ground. *u* is a wire to conduct the electricity; and *h* is the wire which conducts the electricity from the receiver *i*.

Retorts.

12. In many experiments, retorts or flasks furnished with stop-cocks are requisite. They are first exhausted by means of an air pump, and then filled with the gas to be experimented upon. Thus all contact of water may be prevented, and the gases may be previously dried at pleasure.

13. The various tubes used by chemists under the name of eudiometers, do not seem to require a particular description.

CHAP. III.

Apparatus for Experiments on Liquids.

Apparatus for experiments on liquids.

Plate CXLII. Fig. 10.

Plate CXLIII. Figs. 1, 2, 3, 4.

Fig. 5.

SEVERAL of the vessels employed in experiments on liquids, as retorts and flasks, have been already mentioned. We shall take notice of a variety of other vessels. They are in general so simple, that they will be easily understood without much explanation. Fig. 10. represents a balloon glass receiver; and Fig. 1. a matrass, with a wire twisted round its neck to hold it by when hot. Fig. 2. is a glass funnel. Fig. 3. a precipitating vessel. Fig. 4. represents a copper still fitted into a furnace, with the worm and refrigetory. *a* is the still, *b* the head, *c* the worm passing through the refrigetory, which is supposed to be full of water. Fig. 5. is a glass alembic for distillation, fitted with its head and receiver. *a*, is the alembic, *b* the head, *c* the receiver.

Woulfe's apparatus. Fig. 6.

Figure 6. represents a Woulfe's apparatus fitted up for distillation: *a* is a stand, *b* a lamp, *c* a retort fixed above the lamp by means of the ring on the stand, *d* the receiver standing on the support *e*, *f* a tube of safety passing from the receiver to the jar *g*: *h* a tube passing from the jar *g* to the jar *i*. These jars may be continued at pleasure, and the tube from the last jar may pass under a glass vessel standing in a water or mercurial trough, to receive any gas that comes over. Each of the jars contains a quantity of water, into which the tube that enters into it is plunged. In the bend of the tube of safety there is a little water or mercury, to shut out the communication of the external air. The original of this apparatus must be referred to Glauber, who has represented it in his work on furnaces. The improvement introduced by Woulfe was to have a considerable quantity of water in each jar, by means of which, in many cases, a great deal is saved that would otherwise be lost. All the joinings are to be well luted. The tube of safety prevents any bad accident from happening in the course of the distillation. If there happen to be an absorption of air within the apparatus, as is often the case, the external air rushes through the tube of safety and fills up the vacuum. These apparatus are fitted up in a variety of ways by different chemists; but, after the remarks already made, they may be easily conceived by our readers without any farther description.

The other vessels employed in experiments on liquids do not seem to require any particular explanation. They will be easily understood by any person who attends to the properties of the various liquids subjected to experiment.

CHAP. IV.

Apparatus for Experiments on Solids.

Apparatus for experiments on solids.

THE first and most essential piece of apparatus for experimenting on solid bodies, is the furnace. The French have a great advantage over British chemists in the light, cheap, stoneware furnaces, so easily procured in Paris. They are so light as to be easily manageable, and so cheap as not to be beyond the purchase of the poorest experimenter. It is rather surprising that they have not been introduced into Great Britain. They might be constructed with the utmost ease by our potters and crucible makers; and the sale, from the many advantages which they possess, could not but be extensive. When properly hooped with iron on the outside, they would, probably, answer very well for our pit coal fuel.

Furnaces.

Plate CXLIII. Figs. 7, 8.

The best account of furnaces in any English book that we have seen, is in Lewis' *Philosophical Commerce of the Arts.* The practical chemist would do well to consult that excellent treatise. A great variety of furnaces are employed by chemists; but the *wind furnace* may be made to answer almost every purpose. It may be raised to as high a temperature as the blast furnace, by making its chimney of the proper height. We have seen a heat of 160° Wedgewood produced in a very small wind furnace, and iron melted in it with great facility. We shall give a short description of the most improved form of Black's portable wind furnace, the one commonly employed in this country. Figure 7 is an outline of the furnace, and Fig. 8. a section of it. The same letters indicate the same parts in both figures. It consists of an oval iron case, 22 inches high, 20 in its largest diameter, and 15 in its shortest, lined with fire brick or fire clay for about three-fourths of its height from the top, which part forms the body of the furnace, while the under part, which is not lined, forms a very spacious ash pit. *a a*, Is the body of the furnace, which is cylindrical, but a little oblique, that the flame of the fuel may heat the sand more equally than if it were a straight cylinder. The breadth of this cylinder is 8½ inches, and its height 15. The grate *c* lies across the bottom. This fire place has the following openings above the grate: The highest is the large opening at the top, which, when a sand heat is employed, receives the sand pot *i*, and, when this is not wanted, is covered by a thick iron plate lined with clay. The next opening is the elbow of the chimney *f*, which widens as soon as it takes a perpendicular direction, and for the first few inches forms a part of the iron case of the furnace, and is lined with clay. After which it is elongated by an iron tube fitted to it, and not represented in the Figures. The degree of heat is regulated by varying the length of this iron tube. The third opening *e* serves to introduce fuel, and may be employed also to regulate the heat. The fourth opening consists of two small round holes *g g* opposite to each other on the two sides of the furnace. Through them a porcelain or iron tube is occasionally introduced, when it is required to be heated to redness for any particular experiment. The last opening *d* is intended for introducing a muffle. All these openings are furnished with thick brick stoppers and iron plates which slide over them. There are two openings *b b* in the ash pit, which serve to regulate the draught of air, and, of course, to vary the heat of the furnace.

Muffles. Plate CXLIII. Fig. 9. Fig. 9 is a muffle. This is a vaulted flat-bottomed earthen vessel, close at one end and open at the other. It is introduced into a furnace with its open end corresponding to the muffle door of the furnace, and is intended to expose small vessels to heat without being in contact with the fuel. There are usually openings in its sides to allow the entrance of heated air.

Figs. 10, 11. Figures 10. and 11. represent a convenient and cheap blast furnace, contrived by Mr Arthur Aikin from an idea of Dr Lewis in his Philosophical Commerce of the Arts. It consists essentially in two black lead crucibles, one of which *a* is inverted, and the other *b* is placed over it. A hole is bored in the bottom of the crucible *b*, into which the clay stopper *c* (Fig. 12.) is fixed, merely to give firmness. Eight holes are bored in the bottom of the crucible *b*, only two of which are represented in the Figures. Through these holes the air driven in by the bellows, represented in Fig. 10. fixed upon a wooden stand, makes its way to the fuel, and speedily raises a most intense heat. To protect the eyes, it is often necessary to put the crucible *e*, Fig. 13. furnished with the opening *f*, to let out the smoke, over the crucible *b*.

Crucibles. Figs. 14, 15, 16, 17. Figures 14, 15, 16, 17, represent two crucibles, the one triangular, the other circular, with their lids and their supports. These supports are sometimes rolled, as in Fig. 40, and sometimes hollow as in Fig. 41. Crucibles are made of a very refractory clay. The Hessian crucibles are upon the whole the best. The black lead crucibles, made in England, are likewise excellent. They bear sudden heating and cooling well, and they are so soft that they can be conveniently cut with a knife, or saw any way that the experimenter pleases. Of late it is said that micaceous iron ore, or some similar ore of iron, has been substituted for black lead by the manufacturers. This is a grievous fraud, and injures the value of the crucibles most materially. Cast iron crucibles are sometimes used by chemists, but they are not of much value. Crucibles of fine silver are indispensible for the analysis of stony bodies, as silver best resists the action of alkaline bodies at high temperatures. Crucibles of platinum are also indispensible in a good laboratory. They bear almost any temperature, and are but little acted on by most chemical agents.

Mortars. Mortars of various kinds, for pounding solid bodies, are also necessary for the laboratory. There should be one of glass, one of Wedgewood ware, and one of agate. There should also be one of steel, consisting of a hollow cylinder fitted into a flat steel piece. A solid steel cylinder should be fitted by grinding into the hollow cylinder. The hard stone (ruby, for example,) is to be put by little at a time into this mortar, and, by a smart blow with a hammer upon the solid cylinder, it is easily reduced to small fragments. These are ground to an impalpable powder in the agate or flint mortar. The reader will find figures of different mortars, searces, and various other utensils, as files, &c. which we do not think it worth while to mention, in Lavoisier's *Elements of Chemistry*.

Lutes. It may be worth while to say a few words about lutes, which are essential to the practical chemist. Flour, almond-meal, or linseed-meal, make a good enough lute for a common still. They are made into a paste, applied when moist, and allowed to dry. The fat lute answers well for luting retorts and receivers. It is made by beating together pipe-clay and linseed-oil. As it never becomes hard, it is requisite to cover it with linen, and tie the whole firm with a string. The best way is to dip the linen into a hot solution of glue; and to allow the linen to dry after it has been tied on, before beginning the distillation. For coating glass retorts, a mixture, of pipe-clay, sand, horse-dung and glue, made into a thin paste, answers well. The retort is dipped in, and after the first coating is dry, it is dipt again. This is continued till the coating is sufficiently thick for the purpose required. A very good lute for those joinings that are to be exposed to a strong heat is a mixture of clay and borax. We have also used successfully a mixture of clay, sand, and litharge. But this last lute is not so much to be depended on. Many other lutes are to be found in chemical books; but those we have mentioned are the ones which upon trial we have found best.* (c)

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CHEMMIS. See ACHMIM.

CHENOLIA, a genus of plants of the class Pentandria, and order Monogynia. See BOTANY, p. 156.

CHENOPODIUM, a genus of plants of the class Pentandria, and order Digynia. See BOTANY, p. 160.

CHEPEWYANS. See CANADA, p. 343.

CHEPSTOW, a town of England, in Monmouthshire, situated near the mouth of the river Wye, partly in a deep hollow, but chiefly on the steep side of a hill. The houses are tolerably built, and the streets, though irregular, are broad and well paved.

Chepstow was formerly surrounded with walls, and was defended by a strong castle, which seems to have been built in the time of the conquest by William Fitz-Osborn, Earl of Hereford. The remains of this stupendous pile occupy a large tract of ground, and extend along the brow of a perpendicular cliff, of which its walls in many places appear to form a part. The river Wye runs at the bottom of this cliff, and flowing through some of the arches defends it on one side, while on the land side it is protected by an immense moat, and by the lofty bastion towers by which its walls are flanked. The grand entrance on the east, which is by a circular arch between two round towers, is a fine specimen of the early Norman architecture. This entrance leads into the first court, containing the grand hall, kitchen, and other apartments. The second court, which is now used as a garden, is entered from the first by a gate at the side of a round tower; and in the third court, which is entered from the second, is situated the roofless chapel, with pointed arched windows, and tiers of semicircular arches along the wall. A winding staircase at the south western extremity of the third court conducts to the battlements, and the entrance to the fourth court is by a sally port in the wall. The most interesting part of this castle is the grand tower at the south eastern angle of the first court, in which Henry Martin, one of the murderers of Charles I. was confined for thirty years. This tower has generally been represented as a dark and miserable dungeon, but Mr Coxe's description completely contradicts this opinion. "The first story of this tower, (says he,*) contains an apartment which was occupied by himself and his wife; above were lodgings for his domestics. The chamber in which he usually lived is not less than thirty-six feet in length, and twenty-three in breadth, and of proportionate height. It was provided with two fire places, and three windows, two of which appear to be the original apertures, and the third was probably enlarged for his convenience."

The present parish church of Chepstow consists chiefly of the remains of the old priory for Benedictine monks. Within the church, the circular arches of the nave still exist, and the remains of the ancient choir and cross aisle may be traced by the foundations on the outside. The former entrance was by a beautiful semicircular arched doorway, decorated with fine mouldings. A smaller arch, ornamented in the same way, is on each side of the doorway.

The bridge over the Wye, half of which is in Gloucestershire, has a level floor, and was formerly supported by timber piers about forty feet high. It underwent, however, a thorough repair in 1791. The wooden piers still remain in the Gloucester side, but on the other side they have been replaced by stone piers. The massive central pier which separates the two counties is of stone. The wooden piers present a very narrow surface to the stream.

There is an ebbing and flowing well in a garden in Bridge-street, remarkable for the excellence of its water. It is about 14 feet deep, and frequently contains 14 feet of water. A little before high tide, the water begins to subside; at high tide it becomes perfectly dry, and soon after the ebb the water returns. The flow of the well is in no respects affected by wet and dry weather.

As the channel of the river Wye is very narrow in proportion to that of the Severn, and is confined by perpendicular rocks, the tide flows up to the town with great velocity, and sometimes rises to the height of fifty-six feet. Mr Coxe found, that at high water the depth of the river was forty-seven feet three inches, the distance from the surface of the water to the floor of the bridge six feet. As the tide once rose to a notch in the rail two feet ten inches above the floor of the bridge, it follows that the highest tide was fifty-six feet one inch.

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* Coxe's *Historical Tour in Monmouthshire*, p. 378.

Chepstow is the port for all the towns on the rivers Wye and Lug, and vessels of 600 tons burden are built for the Baltic trade. The inhabitants, who are full of activity and enterprise, carry on a considerable trade in the corn and provisions which are produced in the surrounding country. The merchants import their own wines from Oporto, and from Norway and Russia they receive deals, hemp, flax, pitch, and tar, with which they supply Herefordshire, and the eastern part of Monmouthshire. Great quantities of timber are sent from Chepstow to Portsmouth, Plymouth, Deptford, and Woolwich; grain is exported for the Bristol market; and oak bark, cider, coals, grindstones, millstones, and iron, to several parts of Ireland, Liverpool, and other places. Convenient quays are erected on the banks of the Wye for the numerous vessels by which it is frequented.

About two miles to the west of Chepstow is the celebrated mansion of Piercefield, remarkable for its beautiful and picturesque scenery. The following Table contains the statistical information in the population returns in 1811, for the parish of Chepstow.

Number of inhabited houses, ...	421
Number of families, ...	451
Houses building, ...	9
Houses uninhabited, ...	8
Families employed in agriculture, ...	3
Families employed in trade, manufactures, and handicraft, ...	180
Families not comprehended in any of these classes,	268
Number of males, ...	1,158
Number of females, ...	1,423
Total population, ...	2,581

See Evan's and Britton's *Beauties of England and Wales*, vol. xi. p. 175; and Coxe's *Historical Tour in Monmouthshire*. (*π*)

CHEQUE. See CHECK.

CHER, one of the departments of France, which derives its name from the river Cher, and is formed from the higher Berri. It is bounded on the north by the department of Loiret; on the west by the department of the Loire and Cher, and the department of the Indre; on the south by the department of the Allier; and on the east by the department of the Nievre. The superficial extent of the department is about 7385 kilometers, or 468 square leagues of 2000 toises, which is equal to about 1,450,134 square acres.

The principal productions of this department are grain of all kinds, very fine hemp, flax, wines, among which the red wines of Sancerre, and the white wines of Pouilli are the most famous, fruits, honey, wax, wool which is highly esteemed; mines of coal and ochre; quarries of marble; mines of iron, which supply fourteen furnaces and eighteen forges; salmon, and all kinds of fresh water fish. The navigable rivers are the Cher, which is navigable from Vierzon to the Loire, during six months of the year, the Loire, and the Allier, which bound the department on the east. A canal was begun, to form a communication between the Loire and the Cher, by means of the river Erve. The forests of this department occupy 145,000 hectares, about 102 of which belong to individuals, and the rest to the communes and the nation. The contributions, in the year 1803, amounted to 1,742,031 francs. Population, 218,297. Bourges is the capital of the department. The other towns are St Amand and Sancerre. See BOURGES. (*w*)

CHERASCO, QUERASCO, or KAIRASC, a town of France in the arrondissement of Savillan, and department of Stura, situated on a mountain near the confluence of the Stura and the Tanaro. This town, which is derived from the Celtic, *kair* or *kaer*, a city, appears to have been inhabited in the time of the Romans, from the great number of Latin and ancient inscriptions which have been discovered. The town is well built, and the streets are spacious and open. Some of its parish churches, which amount to seven, are very fine. It has also several palaces, in one of which, belonging to the Count Salmatoris, was signed the treaty of 1631, called the treaty of Cherasco; and also the late treaty, by which this part of Italy was added to the French empire. Cherasco was fortified in the modern style, with fosses, bastions, and out-works, by Christina of France, Duchess of Savoy. Epidemic diseases prevail here in a great degree, and are supposed to be occasioned by the exhalations from the rivers Stura and Tanaro. On this account, the town is said, by Denina, to have only about 4000 inhabitants, though, according to the returns of the Bureau de Poste, given in the *Almanach du Commerce* for 1811, the population amounts to 11,200. It carries on a considerable trade in grain, wines, and silk. A fair, which continues for three days, is held on the 18th June; and another for two days on the 14th November. Cattle and victuals are the principal articles of sale. E. Long. 7° 41′, N. Lat. 44° 33′. See Denina's *Tableau Historique Statistique et Morale de la Haute Italie*, p. 53. Paris, 1805. (*π*)

CHERBOURG, a sea-port of France, in the department of the Channel, is situated at the bottom of a large bay, between Cape la Hogue and Cape Barfleur. The principal objects of curiosity are the harbour, the Salle de Spectacle, the garden called Tivoli, the public baths, and the Promenade de L'Abbaye. The road is capable of holding from 500 to 600 vessels; and when the improvements upon the harbour are completed, it will become one of the strongest and safest ports in Europe. The establishment of tides for this port is 9 h. 30 min. Vessels of 900 tons can be admitted at high water, and those of 250 tons at low water. Woollen and cotton stuffs are manufactured here in considerable quantities. There is a manufactory of plate glass, and also a common glass-work. Small vessels for the coasting trade are also built here. The principal articles of commerce are grain, apples for cider, flax, butter, salted beef and pork, and soda of Varech for the glass-works. Population, 14,000. Its position, according to late astronomical observations, is in W. Long. 1° 37′ 9″, and N. Lat. 49° 38′ 31″. (*w*)

CHERLERIA, a genus of plants of the class Decandria, and order Trigynia. See BOTANY, p. 218.

CHEROKEE INDIANS. See AMERICA.

CHERSO, one of the largest islands in the Gulf of Venice, is situated on the coast of Croatia, near to the island of Osero, from which it is separated by a narrow strait, about 15 miles long, and from two to five in breadth. This island is 150 Italian miles in circumference, and gives its name to the capital town. The climate is very wholesome, and the soil, though remarkably stony, is fertile, and watered by a number of rivulets. It produces very little corn; but its cattle, honey, wines, and oils are in sufficient quantities to be exported, and held in much estimation. This island is remarkable for the extreme smallness of its horses, which are, however, strong and spirited, and of a delicate and graceful form. There is here a lake about seven miles in circumference, which abounds in fish, and which is said by the inhabitants to contain several species that have hitherto been found only in the sea. This circumstance has given rise to the opinion, that it has a subterraneous communication with the ocean. The capital of the island, which was anciently called Crispa or Crexa, is said to contain about 4000 inhabitants; and M. Cassas represents them as almost savages. This island, according to some accounts, supports 70,000 sheep, and contains about 11,000 inhabitants. See M. Cassa's *Travels in Istria and Dalmatia.* (x)

CHERSON or KHERSON, KOSLOF or GUSL-OVE, a town of Russia, in the province of Catharinenslaf, is agreeably situated on a small eminence, at the bottom of which runs the Dnieper. The width of this river is about seven versts, and it forms several little isles, covered with shrubs. Cherson is about 14 versts below the mouth of the Ingulitz, and 40 versts above the river Bog. This town was built by the Empress Catharine II. in 1777, and the foundation stone was laid by General Annibal. It is constructed chiefly of hewn stone, which is found at the mouth of the Ingulitz, a distance of almost 15 miles from the town; and it has been considerably improved by Prince Potemkin, who was very partial to the place. It is now, however, gradually sinking into decay, from the unhealthiness of the situation, and from the preference given to Odessa, the air of which is remarkably pure and wholesome. The ancient city stood some miles to the south-west of the spot where the town of Swastopl now stands. The principal public buildings are the arsenal, the fortress, the cathedral, and the admiralty house. The former is a large and interesting edifice, built by Prince Potemkin, and contains a monument to his memory. The fortress, which was also erected by Potemkin, is built in a good style of architecture, of a kind of porous, but durable lime-stone. It occupies a great extent of ground, has a double fosse, and contains some good barracks. The other objects deserving of notice in this place, are the immense flight of steps leading down to the Dnieper, and the battery of stone which is built at the level of the water. The last war of Russia with France has almost annihilated the commerce of Cherson. Before that event, the exportation of corn, hemp, and canvas was very considerable. In 1786, the commerce of Cherson employed 131 vessels, viz. 92 belonging to the Turks, 32 to the Russians, and 7 to the Austrians. The imports consisted of fruits, wines, fish, and household furniture. The exports were soap, wheat, hemp, flour, iron, wool, flax, cordage, tobacco, and wood. It appears, however, impossible, from the difficulty of navigating the Dnieper, that it could ever be a place of great commercial importance. The entrance of that river is extremely narrow; and sometimes north-east winds leave it so full of shallows, that its depth is not greater than five feet. The sands are also continually shifting, which renders the navigation so dangerous, that when Dr Clarke visited the place in the end of 1800, ships were rarely seen in the harbour.

Baron Campenhausen, however, who visited Cherson later than either Dr Clarke or Reuilly, informs us, that the trade had again revived, and that a number of French and Austrian ships, also 300 or 400 Greek barks, were lying in the harbour, the latter of which were laden with Turkish leather, honey, wax, Greek wines, soap, cloth, iron, &c. Several men of war and merchant vessels are built in the docks, which, on account of the bar, are floated down to the Liman, (or swampy fresh water lake,) on camels as at Petersburg. The docks belonging to the crown are situated along the Dnieper. The grand depot of timber is on the opposite bank,* and there is a rope-walk, where excellent ropes and cables are made. The merchants harbour is at the end of the town, and the quay is built on piles. Cherson has a lazaretto which is situated on one of the isles of the Dnieper; but, in consequence of the quarantine being performed at Odessa, where ships are obliged to unload, it is now useless. No foreign merchants of any consequence reside at this port; they transact their business by clerks and supercargoes. Immense herds of oxen are fattened on the vast plains near Cherson, and are sold at low prices. Corn is generally cheap and plentiful, and water melons grow here as large as in Italy. Fuel is entirely supplied by reeds, of which an inexhaustible quantity is produced in the shallows of the Dnieper opposite to the town. They are so tall and strong, that rails, and sometimes temporary houses, are formed of them, and they afford shelter to various kinds of aquatic birds, some of which are of great beauty. This town is badly supplied with water, which is brackish: that which the inhabitants make use of for drinking is brought from a great distance.

Cherson is interesting, as being the place where the philanthropic Howard terminated his career of humanity and usefulness on the 20th day of January, 1790. He was buried in the spot he had himself chosen, in the desert near the village of Dauphigny, about five versts from Cherson. A monument is erected over him, (contrary, however, to his express desire,) consisting of a brick pyramid or obelisk, but without any inscription. Cherson is celebrated also as containing the burial place of Prince Potemkin. He died on the 15th of October, 1791, on the road from Yassy to Nicholaef. Being in want of air, his servants had removed him from his carriage and placed him in a *ditch* that he might be supported by its sloping sides, and in this situation he actually expired. The corpse was soon after brought to Cherson, and buried in the small church belonging to the fortress; and it affords a melancholy, but striking instance of the instability of human greatness, that this most powerful and illustrious of all the imperial favourites, has not now even the poor distinction of a grave. The coffin has disappeared, and the body is supposed to have been taken up and thrown into the ditch of the fortress by the Emperor's command. Great inconvenience is experienced at Cherson from the prodigious clouds of dust and the immense quantity of mud in winter. There are also innumerable swarms of gnats, which are produced in the marshes. Wild boars are frequently seen swimming among the small isles of the Dnieper. In the year 1783, the population of Cherson is said to have amounted to 40,000; but in 1803, when it was visited by M. Reuilly, it contained only 10 or 11,000. East Long. 47°, North Lat. 46° 42′. See Clarke's *Travels*, vol. i. p. 598; Scherer, *Histoire raisonnée du Commerce de la Russie*, tom. ii. p. 33. Paris 1788.; Reuilly's *Travels in the Crimea*, chap. xi.; and Baron Campenhausen's *Travels through several provinces of the Russian Empire.* (x)

CHERSONESUS. See CRIMEA, JUTLAND, THRACE, &c.

CHERTSEY, a town of England, in Surrey, is pleasantly situated within a quarter of a mile of the Thames. The bridge over the Thames was built by Mr Payne in 1785, and consists of seven arches. It is built of Portland stone, and cost L. 13,000. A commodious workhouse, and a good charity school, are the only public institutions. In the *porch house*, at Chertsey, the poet Cowley ended his days. This is supposed to be the spot where the Romans, under Julius Cæsar, crossed the Thames. The river was defended by stakes; and Beda informs us that great stakes, as big as a man's thigh, were to be seen in the 8th century. There was formerly an abbey here, in which was deposited the corpse of Henry VI.; an elegant mansion was built out of the ruins of this abbey, by Sir Henry Carew, in the reign of Charles II. In this town are considerable manufactures of malt, thread, iron hoops, and bricks, which are sent down the Thames to London. The parish contains 652 inhabited houses; 697 families, of which 239 are employed in agriculture, 191 trades and manufacture, and 267 which are not included under any of these heads. The population in 1811 was 3629. See Manning's *History and Antiquities of the County of Surrey*, continued by William Bray, Esq. (π)

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* Timber is dearer here than in the north, on account of the cataracts of the Dnieper, which impedes its being floated down.

CHESAPEAK BAY. See MARYLAND and UNITED STATES.

CHESHIRE, one of the western counties of England, is bounded on the north by the rivers Mersey and Tame, which separate it from Lancashire; on the east by the counties of Derby and Stafford, in which direction the division is marked chiefly by a chain of hills, and by the rivers Goyt and Daner; the southern side unites with Shropshire and Flintshire; and the western border is skirted by Denbighshire, Flintshire, and the estuary of the Dee. The dimensions of the county are estimated by Mr Wedge at about 22¼ miles on a medium in breadth; and in length, from W. S. W. to E. S. E. nearly 40 miles. This statement, however, is plainly inaccurate, the extent of the county, from Bretland Edge, on the Yorkshire side, to Kiddington Green, bordering on Flintshire, being upwards of 50 miles. Its form is rather inclined to an oval, with two projecting necks of land; one about 20 miles in length and 6 in breadth, running out into the Irish Sea, between the estuaries of the Dee and Mersey, and called the Wirral: the other is included in the Macclesfield hundred, and extends from Stockport, between the counties of Derby and York, about 15 miles in length, rarely exceeding 4 miles in breadth. This county is in general flat; but some considerable hills rise near its eastern borders, which are connected with those of Derbyshire and Staffordshire, and extend about 25 miles in length, from Congleton to the N. E. corner of the county. An interrupted ridge of high ground, composed entirely of sandstone, also crosses it from N. to S. on the western side, extending from Frodsham to Malpas, and including the high grounds of Delamere Forest, the hill of Beeston, and the Peckforton hills. There are a few other hills about Macclesfield, and some on the Shropshire side. A chain runs north and south through the peninsula of Wirral. The rest of the county is nearly level; and the principal part of it consists of arable, meadow, and pasture land. The soil is various; but clay, sand, black moor or peat, seem to predominate, the subsoil being commonly clay or marl. The most prevalent stone of the county is the red grit rock, of which most of the towns and villages are built. Large woods are rare; but as hedge rows abound in the generality of farms, the quantity of timber that is produced is considerable, particularly of oak-trees, from which the tanners obtain a valuable supply of bark.

The tenure by which land is held in Cheshire is almost universally freehold; yet, in some manors, there are a few copyholds, or what may be denominated customary freeholds, paying fines and rents certain. Leasing for lives, which was formerly a very constant and general practice, is yet continued by a few landholders; but the most common term of leases is 11 years, with a restriction on the tenant to a certain quantity of tillage, (usually about ⅓ of his farm,) and a particular rotation of crops. The extent of farms is on the average from 150 to 300 acres: some few contain upwards of 500.

The principal object of attention with the Cheshire husbandman is the dairy. In former periods, the county was much celebrated for its produce in wheat; but in later times it has been noted chiefly for its cheese. Strabo and Pliny affirm, that the art of cheese-making was introduced into it by the Romans, but this is improbable from various circumstances; and we are certain that the Roman armies on the continent received a great supply of cheese from this county soon after they had secured the possession of it. The quality and flavour of the Cheshire cheese are well known: the following are some of the principal particulars as to the mode of its manufacture. In a dairy farm of 100 acres, from 10 to 14 acres are under oats; from 6 to 8 are occupied with fallow-wheat, and the like quantity is laid out in summer-fallow; the remainder is appropriated to pasture and hay, the amount of the latter being about 12 acres. The judicious dairy farmer is very scrupulous in the breeding and rearing of calves, and in the management of his cows, both during the summer and the winter. The quantity of cheese made annually from each cow varies from 50 to 500 or more pounds; the produce depending in a considerable degree on the nature of the land, the quality of the pasture, and the mode of wintering: in general, the average may be stated at about 300 lbs. The quantity of milk, according to this estimation, yielded daily by each cow is about 8 quarts, which is commonly supposed to produce one pound (16 oz.) of cheese. The Cheshire cheese is generally made with two meals' milk; but often towards the latter end of the season, (which continues nearly 22 weeks,) with 4, 5, and 6, the cheeses being usually made very large. The most common size is 60 lbs.; a weight susceptible of every excellence to be found in the cheese of this county. Of those large cheeses, two are made in some of the dairies daily. The evening's milk being preserved till next morning, it is skimmed, heated, and incorporated with the new milk, when the whole, together with the cream, being mixed in a large tub, and the proper quantity of rennet and colouring being added, it is left for about 1½ hours to coagulate. When the cheese is come, or the milk is properly coagulated, the curd is broken into very small particles, which are left to subside, and the whey is poured off. This process is repeated till the whey is nearly expelled. Then the curd is placed in a vat, and occasionally sprinkled with salt, of which some dairy women use about three handfuls to a cheese, making it a rule to put the greatest quantity near the middle. The vat is filled very full, and the whey repeatedly squeezed out, before it is placed in the press, as it is very material to expel all the whey, keeping the vat at the same time quite full of curds. The cheese is commonly taken twice or thrice from the vat, to place fresh cloths, pare off the edges, and turn it; and sometimes it is immersed in hot whey, which is supposed to harden its coat. After remaining in the press two or three days, it is next conveyed to the salting house, where it is put in a salting tub, in which having continued for about three days more, it is next placed on the benches for about eight days, being well salted all over, and turned every day. For six or seven days subsequent to this process, it continues to be turned twice daily. Then it is washed in warm water, wiped dry with a cloth, and when dry, smeared over with whey-butter, and placed in the warmest part of the cheese-room, where it is left to acquire the proper age and consistence.

The principal mineral productions of Cheshire are salt and coal. The former is more abundant in this county than in any other part of England; and the immense trade carried on in it, with the vast revenue which it affords, render it an object not only of local, but even of national importance. The places which have been most noted for their salt-works are Nantwich, Middlewich, Winsford, and Northwich. The salt-work at Nantwich was once very considerable; but, in consequence of the superior advantages in respect to situation belonging to other towns, it has now been deprived of a great portion of its former trade. It was expected that that trade would have been renovated in some degree, from the termination of the Chester canal in a bason near to this town; but the expectation does not appear to have been yet realised. Mr Pennant conjectures, that it was here that the native Britons first saw white salt, whence they gave to the place the name of Heldd Wen, or the White Brine Pits. Middlewich derives its name from its central situation between the Wiches or Salt-towns. The salt manufactured there is prepared from brine springs, well saturated. The quantity at this time is not great; but were a demand to offer, it might easily be increased. The great seat of the salt trade in Cheshire at present is Northwich. Here the salt is made from brine springs, and also from the natural rock. This, as it is the chief of the salt towns, is the only one indeed, which, in addition to its brine springs, possesses mines of rock-salt: at least there seem strong grounds for believing, that the beds of rock-salt here are perfectly distinct from any others in the salt district, forming what the Germans would call *liegende stöcke*, lying bodies, or masses of the mineral. It is to be remarked at the same time, that the brines met with in this district are very generally formed, by the penetration of spring or rain waters to the upper surface of rock-salt. The average strength of these brines appears to be much greater here than in any of the springs that occur in Hungary, Germany, or France. In the places where all the principal salt works are situated, they contain between 25 and 26, and in some instances even more, of the pure muriate of soda. The earthy salts held in solution together with this muriate, are principally muriate of magnesia and sulphate of lime, the quantity of which varies in different springs, from $\frac{6}{10}$ to 2 or $2\frac{1}{2}$ per cent. The springs of Cheshire were known to the Romans, and had the common name of Salinæ. The mode in which they turned them to account was very similar to the process now employed, and this process, it is supposed, they communicated to the natives. There is a tradition moreover, that the rock, as well as the brine-pits, were wrought in the time of the Romans. In modern times, however, the discovery of this valuable mineral does not appear to have been prior to the year 1670, since which time it has been found in various places in the vicinity of this town.

The rock salt occurs from 28 to 48 yards beneath the surface of the earth. The first stratum or mine is from 15 to 21 yards in thickness. It very much resembles in appearance brown sugar candy, is perfectly solid, and so hard as not to be broken, but with great difficulty, by iron picks and wedges. Of late, the workmen have been accustomed to blast it with gunpowder, by which means they loosen and remove many tons of it together. Beneath this stratum there is a bed of hard stone, consisting of large veins of flag, intermixed with some rock-salt, the whole from 25 to 35 yards in thickness. Under this bed is a second stratum or mine of salt, from five to six yards thick, many parts of it perfectly white and clear as crystal, others browner; but all purer than the upper stratum, yet reckoned not quite so strong. Only these two distinct beds of the fossil salt have been met with at Northwich; but it has been ascertained, that the same limitations do not exist throughout the whole of the salt district, three distinct beds at least being found in some situations, separated in like manner from each other by intervening strata. The great body of the rock-salt, both in the upper and the lower beds, is composed of crystals of muriate of soda, intimately mixed with certain proportions of clay and oxide of iron, containing likewise small proportions of certain earthy salts.—Throughout, at the same time, particularly in the lower strata of the rock, there are found separate crystalline concretions of muriate of soda in a purer state, variously disposed, sometimes occurring distinctly in the cubical form, in other places in masses of larger size, and irregularly shaped. Above the whole mass of salt lies a bed of whitish clay, which has been used in the Liverpool earthen-ware; and in the same situation there is found also a quantity of gypsum.

Rock-salt pits are sunk at great expence, and are very uncertain in their duration, being frequently destroyed by the brine springs bursting into them, and dissolving the pillars that support the roof; through which, then, the whole work falls in, leaving vast chasms in the surface of the earth. In forming a pit, a shaft or eye is sunk, similar to that of a coal-pit, but more extensive. When the workmen have penetrated to the salt rock, and made a proper cavity, they leave a sufficient substance of the rock (generally about seven yards in thickness) to form a solid roof; and as they proceed, they hew pillars out of the rock, also, to sustain the roof. Gunpowder is then employed to separate what it is meant to raise, which is conveyed to the surface in huge craggy lumps, and is drawn up above ground in capacious baskets made for the purpose. When well illuminated, the crystalline surface of the roof, pillars, and sides of a large pit, make a glittering and magnificent appearance, which seldom fails to have a very impressive effect on the mind of a stranger. Fresh air is conveyed from the mouth of the pit by means of a tube, with a pair of forge-bellows fixed to it; and thus a perpetual current is preserved between the outer and inner air. The pits, at the greatest depth, are dry, and of an agreeable temperature.

The largest rock-salt pit that is now worked in Cheshire, is one in the township of Wilton. This has been excavated in a circular form to 108 yards in diameter; its roof is supported by 25 pillars, each three yards wide at the front, four at the back, and six yards in the sides. Each of these pillars contains 294 solid yards of rock-salt, and the whole area of the pit, which is 14 yards hollow, includes 9160 superficial yards, or little less than two acres of land. The quantity of rock-salt delivered annually from the pits, in the neighbourhood of Northwich, is from 50,000 to 60,000 tons. Hardly more than $\frac{1}{4}$th of this is refined in England, the remainder being exported to various parts of the continent. The salt is conveyed down the Mersey, in vessels from 50 to 80 tons burthen, to Liverpool, where it is reshipped for foreign countries, or kept to be refined.

Besides the great quantity of salt obtained from the rock, an immense weight is supplied by the brine pits, not less than 45,000 tons annually, being manufactured at this town, or in the vicinity. The usual depth of the springs is from 20 to 40 yards. These are situated on a hill at some distance. The briny stream is raised by a steam-engine, and conveyed through very long troughs to the brine-pits. The process of extracting the salt is accomplished by heating the liquor in iron pans, of 20 or 30 feet square, and about 14 inches deep. When it boils a light scum rises to the top, which is taken off, and the liquor reduced to a lower degree of heat: the steam arising is made to evaporate as quickly as possible; and the salt collecting into crystals forms a crust on the surface, which, sinking afterwards to the bottom of the pan, is thence removed once or twice in every 24 hours. The revenue arising from the salt of this county is considered of so much consequence, that a particular board is appointed for its collection and management, quite independent of the excise and customs. The quantity of it made annually for home consumption has been stated to amount to more than 16,000 tons, while the average of the quantity sent to Liverpool for exportation has not been less than 140,000 tons. See Holland's Sketch of the Natural History of the Cheshire Rock-salt District in the *Transactions of the Geological Society*, vol. i. p. 38.

Coal, and various other valuable minerals, are found in abundance in different parts of Cheshire. A small quantity of copper ore has been found in the Peckforton hills; and lead, copper, and cobalt ores occur at Alderley Edge, in the eastern part of the county.

Besides the staple produce of Cheshire, viz. its cheese and its salt, the principal articles of its manufacture consist of silks, cotton, and linen goods. The cotton trade particularly, which has of late been extended into it from Lancashire and some of the bordering counties, seems now, next to the manufactures mentioned, to constitute even the most considerable and flourishing branch of its trade. Manufactures of leather, ribbons, thread, gloves, buttons, and shoes, are carried on at Nantwich, Macclesfield, Congleton, Knutsford, and some other places. A considerable portion of the industry of the county has been laid out also in working its mines, and in increasing the value of that important description of produce. Chester is a great mart for Irish linens. Other commodities imported there are wood, hides, tallow, feathers, butter, provisions, &c. from Ireland; groceries from London; timber, hemp, flax, iron, and tallow, from the Baltic; kid and lamb skins from Leghorn; fruit, oil, barilla, and cork from Spain and Portugal, and from the latter a large quantity of wine, which is indeed the principal article of foreign import. The exports are coal, lead, lead ore, calamine, copper-plates, brass, cast-iron, and vast quantities of cheese.

It is of great consequence towards facilitating the trade of this county, that it is so advantageously situated by nature in respect to the means of water-carriage, and it has been not less fortunate for it, that the means thus placed within its reach of melioration and general benefit have been so assiduously and so wisely improved. Most of the rivers and streams which wind through this county direct their currents northward, and empty themselves into the Mersey or the Dee. The former of these principal rivers divides Cheshire from Lancashire for a course of nearly sixty miles; for about 35 of which, from Liverpool to the mouth of the river Irwell, it is navigable for vessels of considerable burthen. Deriving its source from a conflux of small streams at the junction of the county with Derbyshire, and flowing in a westerly direction, it receives in its course the waters of the Goyt, the Tame, the Bollin, the Irwell, and the Weaver; after its junction with the latter of which, it swells into a broad estuary, and taking a north-western course, soon unites with the Irish channel. The Dee originating in the mountainous district of Merionethshire, and having formed the large lake of Pemble-mere, passes afterwards through a series of very picturesque and grand scenes, till it approaches the western border of the county, to which it forms a boundary from Worthenbury to Aldford. It then passes on to Chester, the walls of which city it nearly encircles, and flows thence to the west through an artificial channel, which was formed at an immense expense by a body of gentlemen, called the River Dee Company. This river forms also a large sandy estuary between the county of Flint and the hundred of Wirrel, and joins the Irish sea about 14 miles north-west of Chester. The Weaver, deriving its source from Ridley Pool, close to Cholmondeley Hall, passes the towns of Nantwich, Minshull, Weaver, Winsford, and Northwich, where it is joined by the Dane from the northern parts of Staffordshire, and two or three other streams from the central parts of the county. Hence it proceeds to Wareham, Acton Bridge, and Frodsham, receiving during its progress several tributary streams, and falling ultimately at the last mentioned point into the swelling bason of the Mersey. Between this place and Winsford it has been rendered navigable by means of several locks. The plan by which this was effected deserves notice, as a memorable instance of local patriotism. The gentlemen of the county observing the great expense of land carriage from the salt-towns, to Liverpool and other maritime places, obtained, in 1720, an act of parliament for the purpose of rendering the Weaver navigable, and empowering them to raise on that account a subscription of L.49,000. The subscribers were to receive 5 per cent. on the principal, and 1 per cent. for the risk, and also certain instalments arising from the tonnage of vessels on the river, till the money advanced was reimbursed; but afterwards the whole amount of the tonnage, deducting only the charges of necessary repairs and management, was to go to the support of public bridges within the county, and to other public useful purposes. Every vessel navigating the river pays one shilling per ton, and the receipt has amounted in some years to L.8000. The debt has consequently been paid off for some time; and this lucrative revenue having been left free, has since been applied to several considerable uses both in town and country. The length of the navigation is 20 miles, in which course it has a fall of 45 feet 10 inches, divided between 10 locks. About 120 vessels, from 20 to 100 tons burthen, are constantly employed here, and are principally occupied in carrying rock salt downwards, and taking up coals in return.

Besides the Weaver navigation, the county of Cheshire is intersected by portions of four canals, which afford the means of a very constant and cheap intercourse of traffic between the towns of Chester, Liverpool, Manchester, the north of England, Staffordshire, Shropshire, and other counties. For forming the Chester canal, after a previous unsuccessful application, an act of parliament was obtained in 1772, with this singular restriction, that the intended canal should not unite or communicate with the Staffordshire canal at Middlewich. It commences at the river Dee, on the north side of Chester, and passing Christleton, Waverton, Hargrave, and the north of Beeston castle, proceeds thence to Nantwich. The branch of the Duke of Bridgewater's canal, which runs through about 20 miles of this county, enters it to the east of Ashton, leaving it again at Runcorn Gap, where it flows into the Mersey. The act for forming this navigation was obtained in 1761; and the whole of it, to the extent of 29 miles, was completed in five years. It has been carried across the Mersey, near Ashton, by an aqueduct bridge; and farther to the west it crosses the Boltin, which running in a tract of low meadows, a mound of earth was raised over this valley to a length, breadth, and height truly stupendous. By these means the water is kept on a level to its egress at Runcorn, where it is precipitately lowered 95 feet by a series of locks of admirable construction. Previously to the formation of this canal, the river navigation from Manchester to Liverpool was 12 shillings per ton, and land carriage 40 shillings; but the rate of conveyance by the canal is only six shillings per ton. Besides the numerous barges which ply here for the carriage of commercial articles, boats on the model of the Dutch treckschuyts have been constructed for the accommodation of passengers, which afford the means of a very cheap and pleasant intercourse between Liverpool and Manchester, and the intervening places. The Grand Trunk canal branches off from the Duke of Bridgewater's at Preston-Brook, and passing Northwich and Middlewich, leaves the county on the south side at Church Lawton. At Preston-on-the-Hill it passes through a tunnel 1241 yards long, 17 feet 4 inches in height, and 13 feet 6 inches wide. A portion of the Ellesmere canal also crosses the western corner of this county, entering it at Palford; and after uniting with the Dee at Chester, crosses the hundred of Wirral for about 9 miles, and then joins the Mersey, thus opening a short and easy passage between Chester and Liverpool.

Besides the several rivers, more or less considerable, which flow through the county of Cheshire, and the canals formed in it, it abounds also with broad sheets of water, denominated meres, lakes, and pools. The principal of these are Oak mere, Rosthern-mere, Mere-mere, Tatton-mere, Comber-mere, Broad-mere, and Bag-mere, Petty-pool, Rookery-pool, and Ridley-pool. Most of these waters abound with fish. There occurs also within the county a spring of mineral water. This is situated in the vicinity of Stockport, and seems to flow from a coal-mine or a bed of iron-stone. Some years ago, when it was first discovered, it was much frequented, as being supposed to afford a remedy for weak eyes and some other disorders. In consequence, however, of an ill-founded prejudice which has since arisen against it, that it occasioned jaundice, it has now been in a great measure altogether abandoned, and has been not less cried down and reviled than it had previously been held in estimation.

In the county of Cheshire there occur various examples of the most sublime and splendid scenery, as well as numerous brilliant prospects. About two miles southward of Tarporley, a small but pleasant town in this district, rises the great insulated rock of Beeston, which is composed of sandstone, is very precipitous on the one side, and on the other slopes gradually downward to the general level of the country. It is nearly 366 feet in height, and commands a very extensive and pleasing view of Chester, and of a great portion of the surrounding country. On the west of this rock are the stately ruins of the far-famed Beeston castle, erected in 1220, by Randle Blundeville, Earl of Chester, which enclosed a space of from four to five acres, and was once proverbial for its almost impregnable strength. The Car Tor, in the vicinity of Mettram, is a very singular precipice of the perpendicular height of about 80 feet, and covered over the summit and sides with oak trees. From its top vast rocks are pendant, which seem to threaten every thing beneath with destruction. The face of the precipice exhibits various strata of rock, coal, or slaty matter, and free-stone, all disposed with considerable regularity, while between it and the opposite and well-wooded hills of Derbyshire, the Mersey, hurrying along its craggy bed, contributes greatly to the grandeur of the contiguous scenery. Weston, in the neighbourhood of the same river, where it joins with the Weaver, is a retired and consequently little noticed, yet really a very beautiful village, environed with several of the most striking features of a luxuriant and highly pleasing natural combination of images and prospects. The Dee, the other great river of this county, is not less without its share of similar embellishment; and it may have been owing, not less perhaps to this circumstance, than to the opinion entertained as to the sacred and purifying nature of its waters, that this river was held in so great veneration as we know it to have been by our British ancestors.

Cheshire contains a great number of considerable towns and villages †. It is also agreeably diversified by the occurrence here and there of a fair proportion of gentlemen's seats, of every degree of antiquity, as well as connected with every variety, as to degrees of wealth and disposition of mind in the proprietors, and consequently varying themselves in an equal degree as to magnificence, taste, and decorations. The county may also lay claim to its full share in the vestiges of an ancient consequence, whether more recent or more remote, foreign or domestic, as well as both of a more general and of a more local nature. While it continued subject to the Romans, this county was included by that people in the division of the country which they named *Flavia Cæsariensis.* Kinderton, in the vicinity of Middlewich, according to the investigation of Mr Whitaker, appears to have been the *Condate* of that people; and various other monuments occur in different parts of the county, indicative of its being held in possession at one period by this race of conquerors. On the final departure of that people from the island, it, with the rest of the country, reverted of course to the Britons, who continued to possess it till about the year 607, when it was conquered by Ethelfreth the Saxon king of Bernicia, who defeated the army of Brochmael Yocithroe, king of Powys, near Chester. On this occasion, Ethelfreth is said to have slain 1200 defenceless monks, whom Brochmael had called from the neighbouring monastery of Bangor, and stationed on a hill in the vicinity, that they might assist him with their prayers. It was afterwards wrested from Bernicia by the Mercians, and continued a part of their kingdom till the reign of Egbert, who united it with the other Saxon states under one government. Alfred divided the county into seven hundreds, exclusive of Chester, which is a county in itself. Canute the Dane, who obtained this division of the kingdom by his famous partition treaty with Edmund Ironside, invested the administration of this county in the earls of Chester, three of whom enjoyed that dignity prior to the conquest; Leofric the son of Leofwin; Algar his son; and Edwin son of the latter, in whom ended the race of the Cheshire earls of Saxon blood. On the conquest, the provinces of Britain, which had hitherto been governed by a few great men, were divided into lesser portions, and distributed as rewards among the followers of the Norman king. Cheshire was bestowed on Gherbot, a valiant Fleming, and after him on Hugh de Aurange, better known by the name

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† In this county there are enumerated 1 city, 12 towns, and 1670 villages.

Cheshire.

of Hugh Lupus. To him the monarch delegated a fulness of power, made this a county palatine, and gave it such a sovereign jurisdiction, that the ancient earls kept their own parliaments, and had their own courts of law, in which any offence against the dignity of the sword of Chester, was as cognizable as the like offence would have been at Westminster against the dignity of the royal crown; for William allowed Lupus to hold this county *tam libere ad gladium, sicut ipse rex tenebat Angliam ad coronam.* The sword with which he was invested for this purpose, is still to be seen in the British Museum, inscribed, *Hugo comes Cestriæ.* As soon as Lupus was firmly established, he began to exert his regal prerogatives, forming his parliament by the creation of 8 barons, who were obliged to pay him attendance, and, with a view to giving it greater dignity, to repair to his court. They were bound, in all wars between this county and Wales, to find, for every knight's fee, a horse with caparison and furniture, or two without furniture, for the division of Cheshire. Their knights and freeholders were to have corselets and habergeons, and were to defend their lands with their own bodies. Every baron had also four esquires, every esquire one gentleman, and every gentleman one valet. Each of these barons had moreover his free court of all pleas and suits, and all plaints, except what belonged to the earl's sword. They had even the power of life and death; the last instance of the exertion of which was in the person of Hugh Stringer, who was tried for murder in the baron of Kinderton's court, and executed in 1597. This species of government continued from the conquest till the reign of Henry III., a period of 171 years, when in 1237, on the death of John Scot, the seventh earl of the Norman line without male issue, Henry took the earldom into his own hands, and gave the daughters of the late earl other lands in room of them, being unwilling, as he said, that so great an inheritance should be parcelled out among distaffs. The king bestowed the county on his own son Edward, who did not assume the title, but afterwards conferred it on his son Edward of Caernarvon. Since that time, the eldest sons of the kings of England have always been earls of Chester, as well as princes of Wales. The palatinate was governed by the earls of Chester as fully and independently, for nearly three centuries after this period, as it had ever been by the Norman earls; but Henry VIII., by authority of parliament, made it subordinate to the crown of England. Yet notwithstanding this restraint, all pleas of lands and tenements, and all contracts within the county, are to be heard and determined in it; and all determinations out of it are deemed void, *et coram non judice*, except in case of error, foreign plea, and foreign voucher; and for no crime but treason can an inhabitant of this county be compelled to be tried out of it. Thus being solely under the jurisdiction of its own earls, and considered in a certain degree as a separate kingdom, representatives to the national parliament were never sent, either for the shire or city, till the year 1549, the third of Edward VI., when, upon the petition of the inhabitants, two members were summoned from each. This practice has accordingly been continued, and Cheshire returns four members to parliament, viz. two for the shire, and two for the city of Chester. It pays 7 parts of the land tax, and furnishes the militia with 560 men. Within the diocese of Chester are comprehended not only all Cheshire and Lancashire, but various parts also of Westmoreland, Cumberland, Yorkshire, Denbighshire, and Flintshire. This diocese is divided into two archdeaconries.

Cheshire contains various curiosities in the departments both of nature and of art. In the library of Vale Royal Abbey, the residence of an ancient family, situated near the centre of the county, there is preserved a very choice rarity, viz. a collection of writings called the Prophecies of Nixon, the famous Cheshire prophet, with respect to whom a pamphlet was published some time ago at Chester, purporting to contain his original predictions, and giving some account of his life. In the register of the church of Frodsham, there occur two remarkable instances of longevity: On March 13th 1592, Thomas Hough was buried at the great age of 141; and, on the succeeding day, Randle Wall aged 103. What is more deserving of notice, is a singular instance that is on record of the versatility of nature, as displayed in the person of a native of this county named Mary Davis, who was born at Great Aughall near Chester, about the year 1598. At the age of 28, a wen-like excrescence appeared above her ear on the right side of the head, and after 32 years continuance grew into 2 horns, which remained for 5 years, and were then shed. These were succeeded by 2 new ones, which, about 4 years from their first appearance, were also cast, and their places occupied by two others. Several portraits were made of this woman when upwards of 70 years of age, one of which is now in the British, and another in the Ashmolean museum. In the latter collection one of her horns is preserved. In 1679, when more than 80 years old, she was exhibited in London.

The following statistical abstract for Cheshire is taken from the recent population return for 1811.

Number of inhabited houses	41,187
Number of families that occupy them	44,502
Houses building	250
Uninhabited houses	1259
Families employed in agriculture	16,396
——————— trade, manufactures, &c. .	23,043
Families not included in these classes	5,063
Number of males	110.841
Number of females	116,190
Total population	227,031
Ditto, including a proportion for those employed in the navy and army	234,600
Increase since 1801	36,500

See Gower's *Sketches towards a History of Cheshire.* Leigh's *Natural History of Lancashire and Cheshire.* Holland's *Survey of Cheshire. Beauties of England and Wales*, vol. ii. p. 183; and *Transactions of the Geological Society*, vol. i. (K)

Chess.

CHESS, an ingenious and very ancient game of skill, played on a board divided into squares or houses, generally 64 in number, with a variety of men or pieces differing from each other in form and in name.

It is generally played in Europe with 16 pieces of a side, painted or stained for distinction's sake, of two different colours, as white and black. Of these 16 pieces, eight are dignified, viz. a king, a queen, two bishops, two knights, and two rooks; and there are eight of lower dignity and equal rank called pawns. They are placed opposite to each other in two lines, at the edges of the board of 64 chequers, in the following order. The white king is to be placed on the fourth black house or square from the corner, on the first or lower line; and the black king opposite to him on the fourth white house, at the adversary's side of the board. The queens are to be placed next the kings, on houses of their own colour. Next to the king and queen, on each hand, the bishops are to be placed; next to them the two knights; and last of all, at the corners of the board, the two rooks.

The pawns are to be placed without distinction, on the second line, or rank, one before each of the dignified pieces.

The moves of the pieces are as follows: The pawns move straight forwards in their own files, one house at a time; but when first played, may be carried forward two houses at a time, if the player chooses. They never move backwards, sidewise, or diagonally, unless in taking an enemy's piece, which is done one diagonal move in advance, the pawn occupying the house of the captured piece—a rule which applies to every case of capture. The rook moves straight forwards, backwards, and sidewise, or by rank or file at pleasure, the whole compass of the board. The bishop moves diagonally, always keeping the same colour, over the whole board, forwards or backwards. The queen combines the moves of the rook and bishop, which renders her a very important piece. The king does the same, only he is circumscribed to passing over one house at a time. The motion of the knight is the most irregular, being a kind of vault over the adjacent square into that which is next to it sidewise, and of a different colour. The range, therefore, of his move, is limited, but it may be either forwards, backwards, or sidewise. The game is not won, in consequence of having taken the pieces of the adversary, but by placing his king in such a situation that he is exposed to be taken, or is *in check*, and cannot move into any other situation without being also *in check*, or exposed to be taken, which is called *checkmate*.

Such is the mode of playing the game in Europe; but in the East, where it is in very great vogue, it is often found in a different form. Frequently the queen has the move of the knight, as well as of the rook and bishop; and sometimes there are additional pieces used, by which the game is rendered much more complicated.

Sir William Jones, in the second volume of the *Asiatic Researches*, describes a very complicated kind of chess, from one of the Sanscrit books called *Puranas*, which has the name of *Chaturaji*, or the game of four kings: being played by four persons representing as many princes, two allied armies combating on each side. It is thus described in the *Bhawishya* Puran, the book alluded to. " Eight squares being marked on all sides, the red army is to be placed to the east, the green to the south, the yellow to the west, and the black to the north. Let the elephant (says the Puran) stand on the left of the king, next to him the horse, then the boat, and before them all four foot soldiers; but the boat must be placed in the angle of the board." Particular rules are subjoined for the conduct of the game; and some of the moves are directed by throwing the dice, in which it differs materially from chess as most commonly played. We refer to the *Asiatic Researches* for what the president has said farther concerning this curious game; subjoining only the following remark: " A ship or boat is absurdly substituted, we see, in this complex game for the *rat'h*, or armed chariot, which the Bengalese pronounced *rot'h*, and which the Persians changed into *rokh*; whence came the *rook* of some European nations; as the *vierge* and *fol* of the French are supposed to be corruptions of *ferze* and *fil*, the *prime minister* and *elephant* of the Persians and Arabs."

In a letter from Eyles Irwin, Esq. to the Earl of Charlemont, in 1793, published in the fifth volume of the *Irish Transactions*, there is an interesting account of the Chinese mode of playing the game of chess. " A young mandarine," says Mr Irwin, " of the profession of arms, having an inquisitive turn, was my frequent visitor; and what no questions could have drawn from him, the accidental sight of an English chess-board effected. He told me that the Chinese had a game of the same nature; and on his specifying a difference in the pieces and board, I perceived, with joy, that I had discovered the desideratum of which I had been so long in search. The very next day my mandarin brought me the board and equipage; and I found that the Bramins were neither mistaken touching the board, which has a river in the middle to divide the contending parties, nor in the powers of the king, who is intrenched in a fort, and moves only in that space, in every direction. But what I did not before hear, nor do I believe is known out of this country, there are two pieces, whose movements are distinct from any in the Indian or European game. The mandarin, which answers to our bishop, in his station and sidelong course, cannot, through age, cross the river; and a rocket boy, still used in the Indian armies, who is stationed between the lines of each party, acts literally with the motion of the rocket, by vaulting over a man, and taking his adversary at the other end of the board. Except that the king has his two sons to support him, instead of a queen, the game, in other respects, is like ours, as will appear in the plan of the board and pieces I have the honour to enclose, together with directions to place the men and play the game."

The Chinese call this game *Chong Kè*, or the royal game; and the following is the mode of playing it, according to Mr Irwin: " As there are nine pieces, instead of eight, to occupy the rear rank, they stand on the lines between, and not within the squares. The game is consequently played on the lines. The king, or *chong*, stands in the middle line of this row. His moves resemble those of our king, but are confined to the fortress marked out for him. The two princes, or *sons*, stand on each side of him, and have equal powers and limits. The mandarins, or *tichong*, answer to our bishops, and have the same moves, except that they cannot cross the water, or white space in the middle of the board, to annoy the enemy, but stand on the defensive. The knights, or rather horses, called *māā*, stand and move like ours in every respect. The war-chariots, or *tehé*, resembled our rooks or castles. The rocket-boys, or *paö*, are pieces whose motions and powers were unknown to us. They act with the direction of a rocket, and can take none of their adversary's men that have not a piece or pawn intervening. To defend your men from this attack, it is necessary to open the line between, either to take off the check or the king, or to save a man from being captured by the *paö*. Their operation is otherwise like that of the rook. Their stations are marked between the pieces and pawns. The five pawns, or *ping*, make up the number of the men equal to that of our board. Instead of taking like ours, they have the rook's motion, except that it is limited to one step, and is not retrograde. Another important point in which the *ping* differs from ours, is, that they continue in *statu quo*, after reaching their adversary's head quarters. It will appear, however, that the Chinese pieces far exceed the proportion of ours, which occasions the whole force of the contest to fall on them, and thereby precludes the beauty and variety of our game, when reduced to a struggle between the pawns, who are capable of the highest promotion, and often change the fortune of the day. The posts of the *ping* are marked in front."

Mr Twiss mentions a small treatise on chess, written, as he supposes, about 400 years ago, at the end of which is a representation of a round chess-board, with directions for placing the men upon it. The board is divided into 64 compartments by four concentric circles, each divided into 16 parts, an empty space being left in the middle. Number 1 is marked or placed in the outermost circle; number 2 in the third circle, counting inwards in the division to the right hand of the former; number 3 is placed in the outermost circle, in the division to the right hand of 2; 4 in the third circle, counting inwards to the right hand of 3; and others alternately from the first to the third, and from the third to the first circle, till the round is completed by 16 on the third circle to the left hand of 1. Number 17 is then placed on the division of the innermost circle to the right hand of 1; 18 on the second circle, counting inwards to the right hand of 17; and thus alternately from the fourth to the second, and from the second to the fourth circles, until the round is completed by 32 directly below number 1. Number 33 then is placed on the third circle, directly to the right hand of number 2; 34 on the fourth circle, directly below number 33. The numbers are now placed in a retrograde fashion; 50 on the outer circle, in that division immediately to the right hand of 1; 51 on the third circle, to the left hand of 2, and directly below number 32; 52 is then placed on the outer circle, immediately on the left hand of 16; and thus alternately on the first and third circles, until the last ground is completed by 64 between the numbers 3 and 5.

On this round chess-board, supposing the black king to be placed in number 48 on the fourth circle, the queen stands on number 17 at his left hand; the bishops in 33 and 2; the knights 18 and 47; the castles 3 and 50; the pawns on 19, 4, 49, 64, and 46, 51, 32, 1. The white king will then stand in 25 opposite to the black queen; the white queen in 40, opposite to the black king, and so forth. In playing on a board of this kind, it will be found that the power of the castle is double to that in the common game, and that of the bishop only one half; the former having 16 squares to range in, and the latter only four. The king can castle only one way; and it is very difficult to bring the game to a conclusion.

The Russians are said to be great proficients at chess; and with them the queen has, in addition to her other moves, that of the knight also; which, according to Philidor, spoils the game, but renders it much more complicated. The Russians play also at chess with four persons at the same time, two against two; for which purpose the board is longer than usual, contains more men, and is provided with a greater number of squares.

In Thibet and the Birman empire, as indeed throughout all the East, this game is held in high estimation. The board used by the Birmans, as we learn from Symes's Embassy to Ava, (vol. iii. p. 289.) is exactly similar to ours, containing 64 squares, and the number of their troops the same, 16 on each side; but the names, the power, and the disposal of them differ essentially. The king and his minister (corresponding to our queen) are mounted on elephants; these are defended by two castles, two knights on horseback, two officers on foot, and eight foot soldiers; the forces of each party are arranged in three lines, by which eight squares remain unoccupied; none of the pieces possess equal force with our queen; by which restricted operation, according to Mr Symes, the Birman mode of playing is rendered more complex and difficult than ours. The game is known in that country by the name of *chedreen*, which bears some resemblance to the appellation by which it is distinguished in most other parts of the world.

It appears likewise from Lord Valentia's late travels in the East, that the game of chess is a favourite amusement with the Abyssinians. "In the evening," says Mr Salt, (who was sent by his lordship into Abyssinia,) "we went into the hall, and found the Ras at chess in the midst of his chiefs. The chess men, which are coarsely made of ivory, are very large and clumsy. When they have occasion to take any one of their adversary's pieces, they strike it with great force and eagerness from its place. I observed that their game differs much from ours. Bishops jump over the heads of knights, and are only allowed to move three squares. The pawns move only one step forward at starting, and get no rank by reaching the end of the board. They play with much noise, every person around, even the slaves, having a voice in the game, and seizing the pieces at pleasure, to shew any advisable move. We observed, however, that they always managed with great ingenuity to let the Ras win every game.

The game of chess is allowed upon all hands to be of very great antiquity; but concerning its origin, as well as the etymology of the name by which it is so generally denoted, a great variety of opinions have prevailed. It has been maintained by many learned writers, that the invention of this game was due to Palamedes at the siege of Troy. The various passages of the ancients, which have been relied on in proof of this opinion, may be seen in Stephen's *Thesaurus*, under the word πεσσος, a *pebble*. One of the principal is the following line of Sophocles:

Εφευρε (sc. Palamedes.) πεσσοις κυβοις τε τερπνον αργιας ἀκος.

But from this nothing more can be inferred, than that Palamedes invented some game which was played with pebbles. From a line in the first book of the *Odyssey*, it has been inferred, that Penelope's suitors amused themselves with this game before the gates of Ulysses's palace. The game played by Penelope's suitors, and called πεττεια, is particularly described by Athenæus, on the authority of a native of Ithaca; (*Deipnosoph.* l. 1.) and it differs very materially from chess, the number of the pieces being 108 instead of 32. The game called πεττεια in Greek, was by the Romans termed *calculi*, or *latrunculi*; and Ovid (*Art. Am.* l. 3.) has so described the manner of playing it, that no person who is in the least acquainted with chess, can conceive that it alludes to this game.

It seems probable, that chess was introduced into Europe by the crusaders in the 11th or 12th century, at which period it was a game in very common use both among the Greeks and Saracens. The Princess Anna Comnena, in the life of her father Alexis Comnenus, who was emperor of the Greeks in the 11th century, informs us that the game of chess, which she calls ζατρικιον, came from Persia into Greece; so that it is in the East that we are to look for its origin. The Persians themselves lay no claim to this invention, but unanimously agree, that they received the game from the Indians at the beginning of the 6th century, during the reign of Chosroës the Great. "The Persians," says Sir William Jones, "though as much inclined as other nations to appropriate the ingenious inventions of a foreign people, unanimously agree, that the game (of chess) was imported from the west of India, together with the charming fables of *Vishnasarman*, in the sixth century of our era." (*Asiatic Researches*, vol. ii.)

This profound orientalist coincides with the learned Hyde, and is decidedly of opinion, that chess was invented in Hindustan, where, he says, it has been immemorially known by the name of *Chaturanga*, that is, the four *angas*, or members of an army, viz. elephants, horses, chariots, and foot soldiers; and, in this sense, the word is frequently used by epic poets in their descriptions of real armies. The Arabic writers have likewise ascribed the honour of this invention to the Indians, and have delivered the following interesting and well-known tradition concerning its origin.

At the beginning of the 5th century of the Christian era, there reigned over the Indies a young monarch of an excellent disposition; but who being corrupted by the flatteries of his courtiers, became the tyrant and oppressor of the lower orders. The *brahmins* and the *royals*, that is to say the priests and the nobles, in vain endeavoured to repress his severities; when a learned brahmin named *Sissa*, undertook indirectly to open his eyes. With this view he invented the game of chess, in which the king, though the most important of all the pieces, is unfit for an attack, or even for self-defence, without the aid of his subjects. The tradition adds, that the scheme was successful. The king became convinced of his error; and, desirous of rewarding his venerable instructor, requested him to name his own recompense. The demand of the brahmin was apparently moderate. He asked only a single grain of corn for the first chequer of the chess-board, two for the second, four for the third, eight for the fourth; and so on in a continually doubling proportion for the whole 64 chequers. The king readily agreed to what appeared so reasonable; but when his treasurers proceeded to calculate the amount, they discovered to their astonishment, that the whole dominions of the monarch were insufficient to discharge the debt. They found, in fact, that such a quantity of corn would be equivalent to 16,384 cities, each of which should contain 1024 granaries, in each of which there should be 174,762 measures, containing each of them 32,768 grains. Upon this the brahmin again took occasion to exhort his majesty how liable he was to be deceived by those who surrounded him; and how necessary it was to take care that a bad use should not be made even of his best intentions.

Certain authors, however, have been more disposed to ascribe the honour of the invention of chess to the Chinese than to the Hindus. Such is the opinion of the honourable Daines Barrington, in his elaborate "Historical disquisition on the game of Chess." (*Archæol.* vol. ix.) Such also is the opinion of Mr Irwin, in the paper already quoted. The young mandarin, named Tingica, who shewed him the Chinese chess-board, claimed this honour for his countrymen, and brought him a Chinese MS. containing an account of the origin of the game. It was an extract from the *Concum*, or Chinese annals, and is as follows:

"379 years after the time of Confucius, or 1965 years ago, Hung Cochu, king of Kiangnan, sent an expedition into the Shensi country, under the command of a mandarin called Hansing, to conquer it. After one successful campaign the soldiers were put into winter quarters, where finding the weather much colder than what they had been accustomed to, and being also deprived of their wives and families, the army, in general, became impatient of their situation, and clamorous to return home. Hansing upon this revolved in his mind the bad consequences of complying with their wishes. The necessity of soothing his troops, and reconciling them to their position, appeared urgent, in order to finish his operations in the ensuing year. He was a man of genius, as well as a good soldier; and having contemplated some time on the subject, he invented the game of chess, as well for an amusement to his men in their vacant hours, as to inflame their military ardour, the game being wholly founded on the principles of war. The stratagem succeeded to his wish; the soldiery were delighted with the game; and forgot, in their daily contests for victory, the inconveniences of their post. In the spring the general took the field again, and, in a few months, added the rich country of Shensi to the kingdom of Kiangnan, by the defeat and capture of its king Choupayuen, a famous warrior among the Chinese. On this conquest Hung Cochu assumed the title of emperor, and Choupayuen put an end to his own life in despair."

Du Halde, however, and the other Chinese missionaries, are not disposed to ascribe the origin of chess to China; and say expressly, that the Chinese themselves acknowledge that they received the game from the Hindus. Mr Freret, in a memoir on the subject in the Transactions of the Academy of Belles Letters, asserts that it is said in the *Haï-Pien*, or great Chinese dictionary, that this game was introduced from India into China under the reign of *Vouti*, about the year 537 before Christ. The claim of the Hindus, therefore, to the honour of this invention, seems on the whole the best supported.

With respect to the origin of the name by which it has been commonly distinguished, Sir William Jones is disposed to derive it from the Sanscrit appellation of *chaturanga*, or the game of the four *angas*, or members of an army. "By a natural corruption of the pure Sanscrit word," says he, "it was changed by the old Persians into *chatrang*; but the Arabs, who soon after took possession of their country, had neither the initial nor final letter of that word in their alphabet, and consequently altered it further into *shatrang*, which found its way presently into the modern Persian, and at length into the dialects of India, where the true derivation of the name is known only to the learned. Thus," adds he, "has a very significant word in the sacred language of the Brahmans, been transformed by successive changes into *axedrez*, *scacchi*, *echecs*, *chess*; and, by a whimsical concurrence of circumstances, given birth to the English word *check*; and even a name to the *exchequer* of Great Britain."

The authority of so great an etymologist must be received with the highest respect; nevertheless it appears almost certain, that the name by which this game was most familiarly known over the East did not import the *game of the four angas*, but the *game of the king*, an honour not unjustly due to the dignity of this most important of all the pieces. Sir William Jones himself states in the same memoir, that the species of chess played in India with four different colours of men, which we have already noticed, though also called *chaturanga*, is more frequently called *chaturaji*, or the *four kings*. Mr Irwin informs us, that the Chinese name for chess is *chong kê*, or the *royal game*; and it was known in Persia under the appellation of *schatrak*, meaning the game of the *schach* or king, and bearing a close resemblance to the *chaturanga* of India. From Persia, chess was introduced among the Constantinopolitan Greeks, and called *ζατρικιον*; whence the *axedres* and *al xadres* of the Spaniards and Saracens. The same term has evidently given rise to the *scaccorum ludus* of the Latins, the *scacchi* of the Italians, the *echecs* of the French, and, finally, the *chess* of the English.

This etymology, which is that of Bochart, is at least more plausible than that of Leunclavius, who derives the name from *Uscoches*, famous Turkish robbers; or of P. Lermond, from the German *scache*, "theft"; or of G. Tolosanus, from the Hebrew *scarch*, "vallavit." It also explains the force of the term *check*, which is employed in the game when the king is in danger from any piece, and which was nothing else originally than the title of the king himself; and it accounts for the origin of the decisive stroke of the game *check-mate*, which is compounded of *schach*, "the king," and *mat*, a word expressing "dead" in Persian and other Eastern languages.

The *schach* or king has retained his name and dignity throughout every variation of the game of chess. The next piece in dignity, however, which has long been called the queen in Europe, was never so denominated in the East; but had the rank of minister, or visir, or *ferz*, among the Persians; a name which it has been supposed, with great probability, was corrupted into *vierge* by the French; whence the origin of a female upon the chess-board. The old French poets, such as the author of the *Roman de la Rose*, call this piece *fierce*, *fierche*, and *fierge*; and, in a manuscript of Lydgate, monk of St Edmund's Bury, quoted by Dr Hyde, the fate of the king in a game of chess is thus described:

> "Was of a *fers* so fortunate,
> Into a corner drive and maat."

The rook or rok has his name, according to Sir William Jones, from the Bengalese *rot'h*, or Persian *rok'h*, signifying an armed chariot; and such, we have seen, is the designation of this piece among the Chinese, according to Mr Irwin. Others deduce it from the Indian name of a *camel*, by which the chariot was drawn; and if we suppose the chariot fitted up like the castle which is fixed on the elephant's back, when he is equipped for battle, we get a plausible origin of the term *castle*, as well as of the form now commonly given to this piece. The *knights*, or *horses* as they are frequently called, have continued unchanged in all the variations of the game; but the same has not been the fate of the piece which we now strangely enough call a bishop. Among the Chinese he was a mandarin; among the Indians an *elephant*, called in that language *fil*, whence seems to have come the *fol* or *fool* of the French. By old English writers, this piece is called *alphin ausin*, or *elphyn*, from an Arabic word signifying an elephant; and he still is called an elephant by the Russians and Swedes. Sometimes he has been an archer; and, among the Germans, he is a *hound* or *runner*. The Poles call him the *priest*, and the English the *bishop*; for what reason it is not easy to say; possibly from an accidental conversion of the cap and bells of the French *fol*, into the bifurcated mitre of a bishop. The pawns are supposed to receive their name from *pedones*, a barbarous Latin term for foot soldiers; but it is more probable that the word comes from an Eastern term of the same import. In China, we have seen that they are called *ping*, which is almost identical with the French *pion*. The Germans, Danes, and Swedes, have converted these subordinate pieces into peasants.

It would be impossible, in a work like ours, to give any thing like a treatise on this interesting game; and we must therefore refer our readers to the work of Philidor; and to an *Introduction to the Game of Chess*, London, 1809, a work which contains an excellent selection of games.

As it is often necessary, however, to refer to the laws of chess, the powers of the pieces, the possibility of winning, and the conclusions of games, we subjoin the following from the above-mentioned work:

Laws of Chess.

1. If you touch a piece or pawn you must play it; but if it is displaced, or overturned by accident, you are allowed to restore it to its place.

2. After quitting hold of a piece or pawn, you cannot take it again to play it to another place; but so long as you keep hold of it, you are at liberty to play it where you please.

3. If you touch one of your adversary's pieces or pawns, he has a right to oblige you to take it, if in your power; if not, to move your king, if you can without putting it upon check.

4. If by mistake, or otherwise, you make a false move, your adversary may insist on your moving your king (as in Art. 3.); but if he takes no notice of it until he has played his next move, neither of you can recal it; the position must remain as if it had been just.

5. If you touch a piece or pawn, which you cannot play without exposing your king to *check*, you must then move your king; which if you cannot do, the fault is of no consequence.

6. If your adversary gives *check* without warning, you are not bound to ward it off, and may consequently play as if such check did not exist; but if on his next move he warns you, each must then retract his last move, as being false, and you must remove your king off check.

7. If your adversary warn you of a check, without however giving it, and you in consequence touch or move either your king or any other piece or pawn, you are allowed to retract, provided your adversary has not completed his next move.

8. You cannot give check to your adversary's king with a piece, which, by your so doing, would discover check on your own king.

9. If you attempt to castle your king when you have no right,—that is, after it, or the rook with which you purpose castling it, has moved,—your adversary may insist on your moving either your king or that rook.

10. After the first game, the players have the first move alternately. If the advantage of a piece or pawn is given, the player giving such advantage is entitled to the first move.

The Value and Power of the Pieces.

King, ...	$6\frac{1}{2}$
Queen, ...	$23\frac{3}{4}$
Rook, ...	15
Bishop, ...	$9\frac{3}{4}$
Knight, ...	$9\frac{1}{4}$
Pawn, power of, . . .	2
——— value of, ...	$3\frac{3}{4}$

From the very principle of the game, the king is invaluable; but its power for attack and defence may be estimated as above.

From the chance which every pawn has of being converted into a more valuable piece, when it reaches the adversary's royal line, its value is estimated at $3\frac{3}{4}$, though its power is only 2.

Conclusions of Games.

1. A single pawn cannot win if the adverse king be placed in opposition to it.

2. A single pawn may win, if the king be placed before its pawn.

3. Two pawns against one must win, almost in all cases; but the player that has the two pawns must avoid changing one of them for his adversary's pawn.

4. A pawn and any other piece must win in all cases; except a pawn and a bishop, when the pawn is on a rook's file, and the bishop does not command the square on which the pawn will reach the royal line.

5. Two knights, without any other piece or pawn, cannot give check-mate.

6. Two bishops may win.

7. A knight and a bishop may win.

8. A rook against a knight makes a drawn game.

9. A rook against a bishop makes a drawn game.

10. A rook and a knight against a rook makes a drawn game.

11. A rook and a bishop against a rook may win.

12. A rook and a bishop against a queen makes a drawn game.

13. A rook and a knight against a queen makes drawn game.

14. A queen against a bishop and a knight may win.

15. A queen against a rook and two pawns makes a drawn game.

16. A rook against a bishop and two pawns makes drawn game.

17. A rook against a knight and two pawns makes a drawn game.

18. At all conclusions of games, when a player seems not to know how to give the difficult check-mates, (as that of a knight and bishop against a king, a rook and a bishop against a rook, &c.) fifty moves on each side must be appointed for the end of the game: these being accomplished, it is to be reckoned a drawn game.

The following short precepts, which have been drawn up as a sort of manual by an experienced chess-player, will be found of great advantage even to an experienced player:

Reflections to be made at Chess before moving any Piece.

Consider, 1. Whether your piece will be defended by another in its new position; and still better, if defended by two or more.

2. Whether the adversary can immediately make an attack upon it; and if by a piece of inferior value, the move is certainly a bad one, unless it be merely preparatory to another move.

3. Consider carefully whether you place your piece, so as to be either on the direct or oblique line with another piece behind it, and open to attack; which is generally a bad position, because your adversary's rook, queen, or bishop may then check both your pieces. This observation, however, does not apply to the case, where your two pieces guard each other; but it applies with peculiar force to the case of the king, and any other piece at a distance from him, on account of the necessity of immediately removing the king from check.

4. Consider well when you attack an enemy's piece, whether you do not force it into a position more disadvantageous to yourself than that in which it was before.

5. If possible, never move a piece till you have discovered your adversary's intention in his last move. If you are unable to do this, try to drive back the piece he has last moved.

6. Consider before moving, whether your adversary can check your king; and if so, how the check can be removed, because the necessity of immediately doing this may occasion you a loss, if you do not keep it always in view.

7. Be particularly on your guard, when the game is in such a situation, that you are exposed to a *check by discovery*, either by the adversary's moving a piece of his own, or driving away one of yours; for an oversight in such a situation will probably cost you the game.

8. When the adversary is intent on bringing up a piece to the attack, prevent him if you can, by placing a pawn, or other piece, so that his piece cannot be moved farther, without being exposed to capture.

9. Never move till you have explored every part of the board, and the situation of every piece; for oversight is the greatest danger you have to dread.

The game of chess, being a miniature representation of a battle, has been a favourite amusement in all ages, with the greatest warriors and generals. The celebrated Tamerlane was a great chess-player, and made use of a board of a peculiar construction, having eleven squares in breadth, and twelve in height, so as to form altogether 132 houses. We read that he was engaged at chess during the decisive battle with Bajazet, in which that emperor was defeated and taken prisoner; and at another time he was engaged at the same game, and in the very act of giving check-mate with a rook, when he was informed, that a son had just been born to him; upon which, to commemorate so remarkable a circumstance, he resolved that his son should have the name of Schachrochk, or *check by the rook*. Dr Hyde quotes an Arabic history of the Saracens, in which it is said, that when Al Mamon's forces were carrying on the siege of Bagdad with so much vigour, that it was on the point of being taken by assault, the besieged caliph, Al Amin, was engaged at chess with his freedman Kuthar. Being warned of his danger, he exclaimed, "Let me alone, for I see check-mate against Kuthar!" Modern history affords similar examples of the power of this game in engrossing the whole soul. John Frederic, Elector of Saxony, having been taken prisoner by the Emperor Charles V., was condemned to death. The decree was intimated to him while he was engaged at chess with Ernest of Brunswick, his fellow prisoner. After a short pause, and making some reflections on the irregularity and injustice of the emperor's proceedings, he turned to his antagonist, whom he challenged to finish the game. He played with his usual ingenuity and attention; and having beat Ernest, expressed all the satisfaction that is commonly felt on gaining such victories. He was not, however, put to death, but set at liberty after five years confinement. We are told, that Charles I. of England was at chess, when news were brought of the resolution of the Scots to sell him to the English; but so little was he disturbed by this alarming intelligence, that he continued his game with the utmost composure; so that no one could have discovered that he had received information of any thing remarkable.

In the Chronicle of the Moorish Kings of Granada, it is related, that, in 1396, Mehemed Balba, who had seized the crown in prejudice of his elder brother Juzaf, after a series of disasters, was killed by means of a poisoned vest. Finding his end at hand, he dispatched an officer to the prison of his brother, with orders to put him to death, lest his adherents should form any obstacle to the accession of his own son. The officer found the prince playing at chess with an *alsaqui*, or priest. Juzaf begged hard for two hours respite, which was denied him. At last, with great reluctance, the officer permitted him to finish the game; but before it was closed, a messenger arrived with the news of the death of Mehemed, and the unanimous election of Juzaf to the crown.

The game of Chess seems to have been known at a very early period in France, of which we have evidence in an account, given by Carte the historian, of a chess-match between Henry I., before his accession to the throne of England, and Louis le Gros, son to Philip of France, which took place at Philip's court in 1087. Louis lost several games to Henry, and a considerable sum of money, by which he was so much irritated, that he threw the chess-men at Henry's head. Henry retaliated the affront, by striking Louis with the board, so that he was laid bleeding on the floor; and Henry would have killed his antagonist, if his elder brother Robert had not interposed. John of Salisbury relates of the same Louis le Gros, in his book *De nugis curialium;* that, in a battle between the French and English in 1117, an English knight seizing the bridle of the French monarch, and crying out to his comrades, "the king is taken!" Louis struck him to the ground with his sword, saying, "*Ne scais tu pas qu' aux echecs, on ne prend pas le roy?*"

There have been various attempts, among modern chess-players, to improve, or at least to vary the game, which have, however, generally died with their inventors. Pietro Carrera, who wrote upon chess in 1617, invented two new pieces, one of which, called *campione*, was placed between the king's knight and castle, and had the move of both these pieces: the other, named *centaur*, was placed between the queen's knight and castle, and had the move of the bishop and knight united. Francisco Piacenza, who styles himself a doctor of laws, proposed another plan of two additional pieces, called a *centurion* and *deacrion*, in 1683. The former, situated between the king and his bishop, unites the move of the knight with that of the queen and castle, for any two squares only: the latter, situated between the queen and her bishop, has the move of the bishop; but only for one square at a time. A still more complicated game of chess was invented by the late Duke of Rutland, of which Sir Abraham Janssen, an excellent chess-player, was extremely fond. The chess-board was 14 squares in breadth, and 10 in height; and the pawns, of which there were 14 on a side, may move either one, two, or three squares the first time. The other pieces were the king, queen, two bishops, two knights, a crowned castle, uniting the move of the king and castle, and a common castle. On the other side of the king was a concubine, whose move united that of the castle and knight, two bishops, a single knight, a crowned castle, and a common one. In this game, the pawns and knights lose much of their value, on account of the extent of the board.

Several other varieties of the game are specified, in which the advantage given by one player to the other, consists in allowing him *il Rè-cavallo*, or *la Donno-cavallo;* that is, that his king or queen may likewise move like the knight. But in the opinion of adepts, the simple form of the game is the best; and is sufficiently complicated to call forth all the ingenuity of the players. One amusing variety, however, still deserves to be mentioned, in which the king, with eight pawns, engages the whole set, on condition of being allowed two moves for every one of his adversary. In this case he can make his first move into check, and his second out of it, by which he has a great advantage; and he cannot be check-mated unless his adversary has preserved his queen and both castles.

The annals of chess record some extraordinary performances of certain adepts at this game, who were accustomed formerly to make a livelihood of their art. Such as Paolo Boi, commonly called the Syracusan, who played at chess with Sebastian, king of Portugal; and at the court of Philip II. of Spain; and his cotemporary Leonardo of Cutri, known by the appellation of *il Puttino*, or the boy. The fame of all these, however, seems to have been exceeded by that of Mr Philidor, whose exhibitions have been made in the presence of many persons still living. This extraordinary chess-player was bred a musician, in the band of the French king; a situation which his father and grandfather had enjoyed before him. At six years of age he was admitted among the children of the chapel royal of Versailles, where, being obliged to attend daily, he had an opportunity of learning chess from the musicians in waiting, of whom there were about eighty. Cards not being allowed so near the chapel, they had a long table with six chess-boards inlaid. Young Philidor soon became greatly attached to the game; and having obtained instructions from Mr de Legalle, who was esteemed the best chess-player in France, he thought of trying to play by memory, having found that he was able to calculate moves, and even whole games at night, while he was lying in bed.

He soon after this offered to play two games at the same time, at a coffee-house in Paris, without seeing either board; and succeeded so well, that he beat two antagonists, to either of whom he, though a first rate player, could only give the advantage of a knight when seeing the board. In the middle of one of the games, a false move was purposely made to try his skill, which, after a great number of moves he discovered, and placed the piece where it ought to have been at first.

Forty years after this he played two different times in London, three games at once. Of one of these exertions, the following account appeared in the London newspapers in May 1783: "Yesterday, at the chess club in St James's street, Mr Philidor performed one of those wonderful exhibitions for which he is so much celebrated. He played, at the same time, three different games, without seeing either of the tables. His opponents were, Count Bruhl, Mr Bowdler, (the two best players in London,) and Mr Maseres. He defeated Count Bruhl in an hour and twenty minutes. Mr Bowdler reduced his game to a drawn battle in an hour and three quarters. To those who understand chess, this exertion of Mr Philidor's abilities must appear one of the greatest of which the human memory is susceptible. He goes through it with astonishing accuracy; and often corrects mistakes in those who have the board before them. Mr Philidor sits with his back to the tables, and some gentleman present, who takes his part, informs him of the move of his antagonist, and then, by his direction, plays his pieces as he dictates."

In 1747, Mr Philidor played a match of ten games with *Stamma*, a celebrated chess-player from Aleppo, giving him the move, allowing a drawn game to be a lost one, and betting five to four on each game.* With all these advantages, Stamma won only two games, of which one was a drawn game. Yet it has been asserted, that, towards the close of his life, this wonderful adept at chess, was so beaten by a Turk whom he met with in the suite of an ambassador from the Sublime Porte, that the mortification which he felt from his defeat had the effect of hurrying on his end. (*m*)

CHESTER, an ancient and populous city of England, the capital of Cheshire. It is situated in the hundred of Broxton, at the distance from London of 181 miles, by Coventry and Newport; by Litchfield of 190. It is thus placed near to the southern boundary of the county, where it stands on a rocky eminence above the river Dee, by a sweep of which river it is half encircled. It consists principally of four streets, running from a centre towards the four cardinal points, and each terminated by a gate in the walls, by which the city is surrounded. In respect of the curious structure of these streets, it is called by Mr Pennant a city without a parallel. They are excavated from the rocky soil to the depth of one story beneath the level of the ground, a circumstance which has been the cause of a singular construction also in the houses. On the level of the streets there are low shops or warehouses, and above them is a gallery on each side, which extends from street to street, being open in front, and balustraded. These galleries, called by the inhabitants Rows, are very uncommon and surprising to strangers, who, when walking in them, can hardly divest themselves of the idea, that they are up one pair of stairs. Along the rows are ranges of shops, and above them the higher stories, which project to the streets, forming a line with the shops situated below. The whole appears as if the first stories of all the houses were laid open, and made to communicate with each other, pillars only being left for the support of the superincumbent structure. The principal streets are intersected by various lesser ones, which cross the others at right-angles, so that the inclosed spaces are divided into several smaller squares. The kitchens and back courts of the houses are on a level with the galleries, while carriages drive about eight feet below; and it is necessary for those who would go from their own houses into any of the principal streets, to descend into them by a flight of several steps. Owing to this singular sort of construction, though such as walk on foot are screened from rain, the shops are at the same time rendered dark and inconvenient; and not only they, but the people also who are walking in the rows, are so hid, that one would imagine there were scarcely any inhabitants in it, though really it is very populous. The buildings of the city are in general ancient, but owing to the interspersion among them of some new ones, the whole has rather a motley appearance. Those of the churches that are principally entitled to notice, are the Cathedral, St Oswald's, and St John's; besides which, there are in the city seven other parish churches, which, as buildings however, present nothing particularly deserving of attention. The cathedral is a spacious irregular pile, that is become ragged through the decay of the mouldering stone with which it is built. The lower part of the wall has a row of arches now filled up, and appears to be the oldest part of the present edifice, though none of it indeed can boast of a remote date. All the labours of the Saxons on this spot, and almost all those of the refounder of the building, Hugh Lupus, are now lost. Simon Ripley, elected abbot in 1483, finished the middle aisle of it and the tower, and the initials of his name are interlaid in cyphers on the capitals of some of the pillars. The columns are thick, surrounded by pilasters, with small rounded arches. Above is a gallery, with a neat stone balustrade in the parts where it is entire, and a row of large and broad-pointed windows. With the exception of these slight fragments, most of the present structure seems to have been built in the reign of the three last Henries. The beautiful west end was begun in 1508, when the first stone was laid with much ceremony. The window over the door is filled with elegant tracery, and the door-case enriched with figures and other sculpture. The descent into the church is by several steps, whence it is reasonably inferred, that the present was erected on the foundation of the ancient church, which was originally on a level with the old streets. St Oswald's church forms a part of the Cathedral. St John's stands without the walls on the east side of the city, and is reported to have been founded by King Ethelred in 689, when he had been admonished in a vision to erect it on a spot where he should find a white hind. It was a collegiate church, and, at the dissolution, was possessed by a dean, seven canons, seven vicars, two clerks, four choristers, and various servants. St Peter's church is in the centre of the city, and had formerly a lofty spire steeple. St Bridget's, on the west side of Bridge Street, is neat and convenient, opposite to which is St Michael's, which, of late, has been much enlarged and beautified. Trinity Church, which has undergone similar improvement, stands in Watergate Street: Its handsome spire has been lately taken down. St Mary's, which is situated in the south-west part of the city, has several very handsome monuments. St Olave's stands in the lower part of Bridge Street, opposite to Castle Street; and St Martin's at a place called the Ash: There are also several meeting-houses, public charity-schools, and alms houses. The meeting houses of the Independents and Methodists are modern, and particularly elegant.

Chester Castle, which stands within the walls on the south-west side of the city, seems to have been rebuilt on the Norman model by the conqueror, and enlarged considerably beyond the space it occupied when possessed by the Saxons. It consisted of an upper and lower ward, the entrance to each of which was defended by a gate and round tower. Within the precincts of the upper ballium * are some square towers of Norman architecture, with square projections at the corners slightly salient. The upper room of one of the towers, called Julius Cæsar's, has a vaulted roof, with elegant and slender couples running down the wall, and resting on round pillars, greatly distinguished by their style and beauty of execution. The remaining part of this court is occupied by the arsenal, batteries, and habitable buildings. The noble apartment, called Hugh Lupus's hall, stood on the east side of the lower ward. The roof was supported by wood-work, carved in a bold style, and resting on strong brackets. The length of the room was almost 99 feet, its breadth 45, and its height proportionable. Adjoining to this building was a smaller one, where the chancery court of the county palatine was held, and where the petty sovereigns of the palatinate assembled in council, with their 8 barons. Enough of these old buildings still remains in competent repair in the higher ward, to afford convenient apartments for the accommodation of the judges on the circuit. All the rest of this edifice has been lately taken down to make room for that magnificent structure, the new county gaol, which is not equalled by any similar building in the kingdom. The gaol is built with white freestone, and contains five yards, with a working room and two day-rooms in each, having separate apartments for the women and debtors. The number of solitary cells for condemned criminals is 14. The principal charge incurred in building this splendid fabric was defrayed by the income arising from the river Weaver navigation. The Propylæum, or grand entrance into the castle, is now building: it extends about 100 feet in front, and consists of a centre, and two wings, or pavilions, of the Athenian Doric order. The great entrance is through the intercolumniations; and the whole is of exquisite design and workmanship.

The walls round Chester are in circuit 1 mile 3 quarters and 101 yards. They are the only entire specimens of ancient fortification in Great Britain, but are now preserved only for the purposes of recreation. The continued walk on the top affords a great variety of prospects. The Welsh mountains, the Cheshire hills of Broxton, and the insulated rock of Beeston crowned with its castle, the rich flat interposed, and the perpetually changing views of the river, are the most prominent and striking objects in this favourite tour. The

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* The space immediately within the outer walls of the castle.—Grose's *Antiquities*.

expence of the repairs is defrayed by certain imposts called murage-duties, collected at the custom-house on all merchandise brought from beyond sea into the port of Chester. The whole annual amount of these is about £200, great part of which arises from the duty on Irish linens, though the sum levied is only 2d. for 100 yards. These walls were formerly defended by several strong towers, but now only one remains, viz. that called the Phœnix tower, from which Charles I. viewed the defeat of his army at Rowston Moor.

The gates were anciently under the protection of the Earls of Shrewsbury, Oxford, and Derby, and the principal magistrates of the city. The guard was maintained by tolls exacted from strangers at each entrance. These gates are all elegant modern buildings. The Dee bridge is an ancient structure, with seven arches of dissimilar workmanship, no part of which, however, is probably older than the conquest. The city mills stand at the north end of the bridge, and are supplied with water from a current formed by a great dam or causeway, which crosses the river obliquely, and causes a fall of nine feet. These mills with the causeway were founded by Earl Lupus, and the revenues anciently derived from them appear to have been very considerable, as every inhabitant of the city, with the exception of the tenants of the Abbey, was restricted from grinding his corn at any other place. The present extensive premises, which are regarded as extremely complete in their construction, were erected a few years ago, the old mills having been burnt down. The city is chiefly supplied with water from the adjoining works, which raise it from the river into a reservoir, whence it flows through pipes into the houses.

The exchange is a handsome pile, supported partly by columns, and is 126 feet long. It contains, in the south end, a mayor's banqueting-room, which is occasionally used as an assembly room for dancing. In the centre is a spacious hall, in which the courts of sessions, of crownmote, portmote, and annual elections, are held. The north end is occupied by the justices' room, the sheriff's court, the town clerk's office, and other public offices of the city. It was erected in 1698. Near to this building is the engine house, a neat fabric with pilasters, and a rich Corinthian cornice. The fire engines are preserved in order at the expence of the community. In the square opposite the exchange, the market for fish and vegetables is kept. Salmon was formerly sold here in such profusion, that masters were frequently restricted, by a clause in the indentures, from giving it to their apprentices more than twice a week. At a small distance from the exchange are two flesh shambles, which occupy a considerable portion of the street. Here the country butchers are permitted to sell meat on market days. On the top of one of the shambles is a capacious cistern or reservoir, which is supplied with water from the works at the bridge, for the use of the inhabitants of the higher parts of the city.

The infirmary is a handsome structure, pleasantly situated in an airy spot on the west side of the city. Eastward of it is the entrance into the Abbey-court, over the gateway of which is the register-office for wills. The Abbey-court is a pleasant square, and the houses are regular and handsome. Here also is the bishop's palace erected in 1753. The Gothic structure of St Thomas's chapel, the residence of the late Dean Swift, has been taken down, and an elegant mansion erected on the site which it formerly occupied. Of the houses of this city in general, it is to be observed, that many are constructed of timber.

The government of the city of Chester assumed the form of a regular corporation as early as the reign of Henry III. The last charter in its favour was granted in 1676 by Charles II. According to this, the government of the city is vested in a corporation, consisting of a mayor, recorder, 2 sheriffs, 24 aldermen, and 40 common councilmen. Of the latter two are leave lookers, whose office it is to inform of all persons exercising trades within the city without being freemen. The two senior officers are murengers, or receivers of the murage duties for repairing the walls; and two are treasurers, who are usually next in succession to the mayor. There are likewise a sword and a mace-bearer, and various other inferior officers. The exclusive power of election into their own body is assumed by the corporation, though the right of such election was, by the charter of Henry VII., vested in the freemen, citizens who by their own unwise conduct have forfeited the privilege. This city has often been honoured with royal visits, and is remarkable for its perseverance in the cause of royalty when besieged by the parliament army in 1645, at which period the inhabitants of the garrison were exposed in the severest manner to all the calamities of the most distressing famine.

Chester is distinguished as a sort of provincial metropolis, many of the gentry of the neighbouring counties making it a place of occasional residence. Its poorer classes of inhabitants are chiefly occupied in the trades common to a great town, inhabited by opulent families. The only manufacture of consequence is that of gloves, which are made in vast numbers, principally by women. Here are also a small manufactory of tobacco pipes, iron foundries, snuff mills, and large establishments for ship-building, which furnish additional employment. The latter business is carried on to great advantage, many vessels from 100 to 500 tons being built yearly. These, in point of strength and beauty, are reckoned as complete and durable as those built in any other port in the kingdom: the materials are entirely of British oak. Two manufactories for shot, and one for white and red lead, are likewise established here. The shot is exported to America in large quantities.

The maritime business of Chester chiefly consists of the Irish and coasting trades, with a small portion of trade to foreign parts. The quantities of linen cloth imported from Ireland are very great; and for the better accommodation of the merchants, a new hall was erected in the year 1778: this is a handsome square brick building, inclosing a spacious area, and containing 111 shops. Besides linen, there are various other articles both of import and of export; for an enumeration of which, see the article Cheshire. From the large cheese warehouse on the river, vessels are laden with cargoes of this article for London. The limits of the port extend on the Cheshire side of the Dee as far as the end of Wirral, and on the Flintshire side to the mouth of the river Clwyd; yet notwithstanding this, and for all the variety at the same time in the commercial objects here attended to, the number of ships belonging to the port is but small.

The port of Chester was much improved during the last century. The great breadth of the estuary of the Dee, and the comparative smallness of the body of water flowing through it, rendered it liable to be choked up by the sand brought in with the tide; and this gradually took place to such a degree, that in the year 1674 vessels of 20 tons could scarcely reach the town, while ships of burthen were obliged to lie 10 miles farther down below Neston. In that year, accordingly, a plan was devised for the purpose of making a new channel for the river, and at the same time of recovering a large tract of land from the sea by embankment. In the year 1732, a company was established for the execution of this project, through whose exertions, though with much difficulty, and after many losses, a fine canal was made, with high banks, by which the river is confined, for the space of eight miles, with such a depth of water, as to allow vessels of 350 tons burthen to come up to the quays at common spring tides. The cross embankments, made at the same time, have preserved a considerable quantity of land from the sea, and flourishing farms now occupy the space that was formerly bare sand, covered every tide by the water. Two ferries across the canal, or new river, preserve the communication with the opposite country of Wales.

The population of Chester, on an enumeration made in the year 1781, was found to be 14,860. Of this number 6339 were males, and 8521 females; and, by various calculations drawn from the bills of mortality, the proportional healthiness of the city appears to be considerably greater than that of most other towns in England. This may possibly be owing to two causes independent of the salubrity of the air; the situation, viz. of the buildings, on a dry sand-stone rock, and the far less proportion of poor inhabitants than is usual in places whose chief support arises from manufactures. It has been remarked that in this city the number of births is equally disproportionate as that of deaths, to the amount of the existing population.

The city of Chester returns two members to parliament. It was first called to send representatives thither in 34th Henry VIII. who vested the right of election in the freemen, consisting at present of 1200 voters. The religious sects that occur here are associated chiefly in the different classes of Presbyterians, Independents, Quakers, Methodists, Catholics, and the followers of Emanuel Swedenbourg.

The public charities of Chester are numerous. Those more particularly worthy of notice are the Infirmary before mentioned, the House of Industry, the Blue-coat hospital for boys and girls, and the various alms-houses dispersed through the city. The Infirmary took its origen from a bequest of L. 300 left by Dr Stratford, commissary of the archdeaconry of Richmond, and has been increased by voluntary contributions. Before the present building could be prepared for the reception of patients, a temporary infirmary was established in Northgate street, in the year 1756. The new infirmary was opened on the 19th May, 1761, and has been supported by such liberal subscriptions, that the governors have been enabled to administer relief to many thousand persons. The utility of this institution was increased a few years ago by the admission of fever-patients, for whom a distinct ward was appropriated, and due precautionary means employed to prevent any infection from communicating with the other parts of the house. The whole affairs of the establishment are conducted in a judicious and praise-worthy manner. The Blue-coat hospital, which was founded in 1706 by Bishop Stratford, was originally endowed for the complete maintenance of 35 boys for four years, a sufficient sum being allowed to bind them apprentices at the expiration of that time. From the subsequent increase of the funds of the hospital, its utility has been much extended. A school has been established in another part of the building, on the plans of Mr Lancaster and Dr Bell, in which upwards of 130 boys are taught the most useful parts of education. To these monuments of public benevolence, must be added the splendid munificence of Lord Grosvenor, who has erected and supports a school of upwards of 400 boys, and a great number of girls, at his own expence. In another part of the city, a diocesan school is maintained, for the purpose chiefly of instructing youth in Bell's system of education, preparatory to commencing masters. To these may be added several Sunday schools, maintained by public subscription. By these means, all the infant poor receive a competent education. In the Blue School for the education of girls, which is supported by ladies, eight of the girls who are thus provided for, are maintained in board, lodging, and clothes; the others are only clothed. When they leave school, they are placed out to service, and receive each 40 shillings. Of the beneficent institutions in the city, the chief is that for the benefit of decayed freemen of 60 years of age and upwards, 40 of whom are allowed from this establishment L. 4 annually, and a gown every third year. Mr Owen Jones, one of the donors of this charity, bequeathed the profits of an estate in Denbighshire to the poor of the several city companies, who were to receive it in rotation annually. The yearly value of this bequest was originally but a few pounds; but the discovery and working of a rich lead mine on the estate, have so improved the receipts, that the annual income is now nearly L. 400.

A benevolent institution, of a nature before unknown in England, was begun in this city in the year 1774. Its objects were to prevent the natural small-pox from becoming dangerous, by promoting a general inoculation at stated periods, and to keep it from spreading whenever it should break out, by the observance of certain rules drawn up for the occasion. Subscriptions were liberally bestowed for the purposes of this society, and the rules, when steadily observed, were found to be fully efficacious in arresting the progress of contagion; but the supineness of the people, and their superstitious rejection of the offer of free inoculation, rendered the scheme abortive, and it was at length abandoned. The projected plans for its revival have been completely superseded, in consequence of the introduction of the vaccine inoculation.

Between the walls of the city on the west side and the river is an extensive meadow, called the Rood-eye, or Island of the Cross, which in different successive periods has been appropriated to diversity of amusement, and chosen as the place for the exhibition of various feats of bodily activity. It is here that the races are now held, for which, indeed, no situation could be better adapted, the whole lying like an amphitheatre immediately beneath the walls. The season in which these races are annually celebrated is the first week in May.

Chester is supposed to have been founded by the Romans, and indeed plainly appears to have been a station belonging to that people, as well from numerous indications of such an origin and character in its general aspect and mode of structure, as by the many antiquities which have been and still continue to be discovered in and about the town. In the days of that people, it seems to have held a very eminent rank, to have maintained the Roman splendor longer, and to have been later deserted by that people than most other of the British towns; and even to this time the monuments both of its intimate connexion with that race of men, and of its consideration at various subsequent periods, and during the preponderance in the island of other nations, are by much too numerous to admit of being particularly specified in this place. When it was quitted by the Romans, it may be remarked, that the Britons maintained their liberty in it long after the

Saxons had got possession of the rest of the country. From the time that it became subject to the latter people, till the reign of Charles I. it continued to be the constant scene of action between contending parties, and, like every other eminent place in similar circumstances, severely felt the scourge of the ruling factions. Under Henry VII. and VIII. it first enjoyed some respite, and the immunities granted by those monarchs were confirmed by Charles II. out of gratitude to the city for its unshaken fidelity to his unfortunate father. Chester is a bishop's see. It was anciently part of the diocese of Litchfield, one of whose bishops removing the seat of his see hither, A. D. 1075, his successors came to be frequently styled bishops of Chester. It was not, however, till the time of the general dissolution of monasteries under King Henry VIII. that this was erected into a distinct bishopric. This diocese now contains the counties of Cheshire and Lancashire, part of the counties of Westmoreland, Cumberland, and Yorkshire, two chapelries and five parishes in Flintshire; in all 236 parishes, of which 101 are impropriations. Of the livings of the city, St John's is a vicarage, St Olave's a curacy in the patronage of the bishop; the rest are rectories under the same patronage, with the exception of Trinity, which is in the gift of the Earl of Derby.

The annual fairs of Chester, which are among the most noted in England, are held on the last Thursday in February, which is for cattle only; July 5. and October 10, for cattle, Irish linen, cloths, hardware, hops, drapery, and Manchester goods: The two last continue upwards of three weeks. The stated market days are Wednesday and Saturday, when there is an abundant supply brought up of every article of provision. The city is situated in N. Lat. 53° 12′, W. Long. 6° 3′.

Number of inhabited houses in 1811,	3,296
Families that occupy them,	3,745
Houses building,	15
Houses uninhabited,	161
Families employed in agriculture,	397
Families employed in trade and manufactures,	2,296
Families not included in these classes,	1,052
Number of males,	7,007
Number of females,	9,133
Total population,	16,140

See Aikin's *Description of the country round Manchester*; Pennant's *Tour in Wales*, and *Tour from Chester to London; Hist. and Antiq. of Chester;* Norden's *Cheshire*, &c. (K)

CHESTERFIELD, a town of England, in the hundred of Scaresdale, and county of Derby, is situated on the side of a hill, between two rivulets, called the Ibber and the Rother. It is large and irregularly built, and contains few objects that are particularly deserving of notice. The church, which was erected towards the end of the 11th century, is built in the form of a cross, and is both spacious and handsome. Its spire, which is 230 feet high, and is built of timber, covered with lead, is distorted in such a singular manner, that it appears to deviate from the perpendicular in whatever direction it is approached. In the chancel is the burying-place of the family of the Foljambs. Two large altar tombs, and several inscriptions, still remain. Previous to the tenth of Richard I., a hospital for lepers was founded in this town, and continued till the time of Henry VIII. The grammar school, or chapel school as it is called, was founded in the reign of Queen Elizabeth, and was at one time the largest in the north of England. The school-house was built in 1710. An elegant town-hall, comprehending the debtor's gaol, the gaoler's house, and a large room for holding the sessions, was built a few years ago in the market-place; and, about the same time, a handsome assembly room was built at the Castle Inn. The principal manufactures of Chesterfield are stockings, coarse earthen-ware, carpets, and shoes, of which large quantities are annually sent to London. There is also a silk and cotton mill here, and great quantities of lead are sent from this place by the Chesterfield canal which joins the Trent below Gainsborough. The iron works in the town and neighbourhood likewise furnish employment to the inhabitants.

The market is well supplied with corn, lead, malt, leather, stockings, blankets, and bedding, in which articles a very considerable trade is carried on with the neighbouring towns.

In the parish of Chesterfield there were, in 1811,

Inhabited houses	951
Families	973
Families employed in agriculture	51
Families employed in trade	538
Males	2025
Females	2451
Total population	4476

See *Description of England and Wales*, vol. iii. p. 117; and Britton and Brayley's *Beauties of England and Wales*, vol. iii. p. 537. (*w*)

CHESTER-LE-STREET, supposed to be the *Condercum* of the Romans, is a very large and thriving village, situated in a valley to the west of the river Wear, opposite to Lumley Castle. The houses are chiefly arranged in a street about a mile in length, and the principal public buildings are the church, and the deanery house. The church is a handsome stone building with a nave, side aisles and tower, and contains numerous monuments, with effigies of the noble family of Lumley. The spire, which is of stone, is 156 feet high, and is reckoned one of the finest in the north of England. At Whitehill or Whitwell, in the neighbourhood, iron is made of ironstone, dug out of pits. According to the returns in 1811, the parish of Chester-le-Street, which includes the townships of Lambten, Great Lumley, and little Lumley, contains 267 inhabited houses, 273 families, and 1205 inhabitants. See Brayley and Britton's *Beauties of England and Wales*, vol. v. p. 186; and Hutchinson's *Durham*, vol. ii. p. 398. (*j*)

CHIAMPA. See TSIAMPA.

CHIAPA. See GUATIMALA.

CHICHESTER, a city of England, in the county of Sussex, is situated in a level tract of country, on ground a little elevated, and is surrounded on every side but the north by the river Lavant. This town was formerly encompassed with a stone wall, having four gates corresponding with the four cardinal points. From each of these gates was a street which derived its name from the gate, and terminated in the market-place, in the centre of the city. These four principal streets have a considerable width, and are well paved; but the gateways are now destroyed, and only a few parts of the embattled wall remain. One of the remaining portions of the wall is on the north side of the city, where an extensive terrace was raised in 1725, and now forms an elegant promenade.

The principal public buildings of Chichester, are the cathedral, the churches, the market cross, the market house, the guild-hall, the bishop's palace, a theatre, (situated at the bottom of South-street), a work-house, a custom-house, a free school, and some chapels. The cathedral, with the bishop's palace and the houses of the dean and prebendaries, occupy the space between the west and south-west gates. The length of the cathedral from east to west is 410 feet; the height of the central tower and steeple 270 feet; the height of the towers at the west end 95 feet; the height of the tower on the north-west side of the church 107 feet; and the height of the roof or vaulting 61 feet. About a century ago the spire was struck with lightning, and some large stones, one of which was three-fourths of a cwt. was thrown over the houses into West-street. Among the numerous monuments affixed to different parts of the cathedral, one of the most interesting is the monument erected by the inhabitants of Chichester to the poet Collins, who was a native of the town. It is executed by Flaxman with his usual taste and ability. The seven churches are all built with flint stones. In the middle of the market-place is a stately octangular cross, supported on eight arches, highly ornamented, and reckoned superior to any thing of the kind in England. The market house is built of stone, and supported by stone pillars. The guild-hall, though mean, is a spacious and ancient building. The bishop's palace, built in 1727, is more remarkable for its size than its beauty.

The river Lavant is navigable for small vessels. The quay and harbour is about two miles from the town, and four from the sea. Large quantities of salt were formerly made at Chichester, and there was also a great manufacture of needles. Baizes, coarse cloths, and blankets are manufactured here; and ship-building is carried on to a considerable extent.

According to the recent population returns for 1811, Chichester contains

Inhabited houses	1083
Families	1286
Families employed in agriculture	72
Families employed in trade and manufactures	803
Males	2878
Females	3547
Total population	6425

See the *Architectural Antiquities of Great Britain*, vol. i.; and Hay's *History of Chichester*. (*w*)

CHILI.

Chili.

CHILI is a country of South America, stretching along its western coast, and confined on the east by a chain of the Cordilleras. It occupies that space which lies between the 24th and 45th degrees of south latitude, and between the 68th and 74th of west longitude. In treating of this country, we shall comprehend our account of it under two general divisions; the first containing the History, the second the Statistics of Chili.

PART I. HISTORY OF CHILI.

History.

Origin of the Chilese.

FROM a total want of records, the origin of the Chilese is still obscure and undetermined. Their own opinions, as well as their traditions on the subject, are altogether so vague, imperfect, and contradictory, as at best to afford only the means of conjecture. Some of them would lead us to conclude, that Chili was settled from the west; others, that its inhabitants came from the north; and others, that they are indigenous. That America, in general, was peopled from Asia, is an opinion very common and well supported; but it still remains to be decided, whether all its inhabitants are of the same origin, and received from the same point of communication, the north-east of Asia. Molina supposes that Chili, in common with the rest of South America, was originally settled from the southern parts of Asia. In support of this, he alleges the general similarity of language and character, which, to this day, are still observable in their respective inhabitants; and, in order to shew some probable line of communication, has recourse to an ingenious but rather bold conjecture. He imagines, that a vast extent of country has once united the two continents towards the south, but that this, by the gradual encroachments of the Pacific Ocean, has since that time been reduced to a chain of islands. From suppositions of this nature, and with materials such as we have mentioned, it would be vain to pursue an inquiry, which could only betray us into the labyrinths of theory, without leading in the end to any certain or satisfactory conclusion.

The Peruvians invade Chili.

It is to the Peruvian annals that we are indebted for the earliest accounts of Chili, and from them we have nothing prior to the middle of the fifteenth century. At that time the Peruvians greatly surpassed all their neighbours in civilization. They had already brought many of them under subjection, and were soon excited to the conquest of Chili, by the natural advantages of the country, the fertility of its fields, and the delightful salubrity of its climate. Anticipating the difficulties of an enterprise the greatest they had yet undertaken, it was not entered upon without the most cautious deliberation, and nothing was omitted, that might tend in any degree to procure a successful issue. At length, after the minutest enquiries, Yupanqui, the tenth Inca, marched with a numerous army to the frontiers of Peru, and having there established his court in the province of Atacama, dispatched Sanchiruca, with part of his troops, for the subjugation of Chili. Preceded by ambassadors, the Peruvian general entered the country with very slight opposition, and almost without a blow reduced the whole of the southern provinces, as far as the river Rapel. Beyond this was a people very different from the unwarlike tribes, which had already been so easily and rapidly subdued. They were named Promaucians, or *free dancers*, a high-minded people, fond of the peaceful amusements, but still fonder of liberty. They met with vigour the invaders of their independence; and in a battle of three, or, according to some accounts, of six days continuance, completly routed the Peruvians, drove them from their territories, and compelled them to limit their acquisitions in Chili, to those less formidable and already subjected provinces, which lie north of the Rapel. Upon these provinces the Inca imposed an annual tribute of gold, but no innovation was attempted, either in their customs, manners, or government, all of which they were suffered to retain free and unaltered till the year 1535, when Chili was invaded by the Spaniards under Diego Almagro.

Invasion of Chili by the Spaniards under Diego Almagro.

These brave but unprincipled adventurers had already conquered Mexico, and overrun, with incredible success, the whole kingdom of Peru. Still, however, unsatisfied, their avarice and their ambition were yet farther allured, by the rich mines and the beautiful plains of Chili. Almagro left Cusco with 570 Spaniards, and 15,000 Peruvian auxiliaries. Disregarding all the remonstrances of his confederates, he preferred passing the Cordilleras, to the other more distant, but, at that season, less dangerous entrance, by the desert of Atacama. Unfortunately, however, winter had already commenced when they reached the Cordillera Nevada, and, in the course of their passage, the snow fell in such abundance, and the cold became so intense and overpowering, that not less than 10,000 Peruvians, with 150 Spaniards, perished in the march; the rest were happily extricated by the activity of their leader. Almagro with a few horse having reached the plain, procured assistance and provisions for his exhausted soldiers.

They are well received in the northern provinces.

They were received in Copiapo with the most benevolent hospitality, and, in a short time, were completely recovered of their fatigues. The northern provinces had been subdued, and were still tributary to the Peruvians; and here the Spaniards were unexpectedly gratified by the distribution of 500,000 ducats, which Paulu, the Peruvian leader, well acquainted with the views and disposition of his associates, had exacted from the inhabitants, and presented to Almagro. This present gave a strong impression of the riches of Chili, and animated the soldiers in the prosecution of their enterprize.

Cruelty of Almagro.

Before leaving Copiapo, they were joined by reinforcements from Peru; and, in their progress southwards, were every where treated by the natives with liberality and respect. They were even regarded as beings of a higher nature, more allied to divinity than to the common race of mortals. This convenient persuasion was as industriously propagated as it was credulously believed. But we must here notice an occurrence, which served, in no small degree, to undeceive the deluded inhabitants, and to develope, in its true light, the character of their new friends. Two stragglers from the Spanish army being put to death, and we may suppose not without sufficient grounds for the severity, by the people of Guasco, Almagro instantly proceeded to take a cruel vengeance on the offenders. He arrested the Ulmen or governor of the guilty district, his brother, and twenty more of the principal inhabitants; all these, together with an usurper of Copiapo, whom he had lately deposed, were at his command, without even the formality of justice, committed at once to the flames. This conduct of Almagro did not pass without censure; even his own Spaniards were displeased, and openly reprobated the barbarity of their leader. Familiar as they had long been with robbery and slaughter, some were still found among them, who had not utterly renounced all the sympathies of humanity.

Battle with the Promaucians.

Almagro now entered the country of the Promaucians. That gallant people had on a former occasion successfully resisted all the efforts of Peru. At the first appearance of the Spaniards, they stood amazed and confounded. The Spanish horses were the first they had ever beheld; but still more wonderful were the mysterious weapons which these strangers brought along with them. They were surprised, but not intimidated; and both armies drew up for battle, on the shore of the Rio Claro. The Peruvians, whom Almagro had posted in front, were soon broken and routed, and fell back with terror on the Spanish line. The Spaniards themselves were able with difficulty to sustain the furious attack; they were not a little astonished at the resolute valour and fearless impetuosity of their new assailants. The struggle was obstinate, bloody, and doubtful, and night alone put an end to it. The Promaucians, however, remained in sight of their formidable enemy, with a determination to renew the fight next morning. The Spaniards kept the field, and claimed the victory; but a victory of such perilous achievement they had neither expected nor desired, and they were now fully persuaded of what indeed the Peruvians had before warned them, that the country of this people was not to be won by the force of prejudice alone, but by arms and valour, fatigue and bloodshed.

The Spaniards return to Peru.

It is seldom that men have resolution patiently to undergo toil and danger in the attainment of an object, when their anticipations had prepared them for neither. So it happened with the Spaniards; they resolved unanimously to abandon the enterprise. Some of them, indeed, expressed a desire to remain in the country, and form a settlement in the northern provinces, where the natives were of a milder and less warlike disposition. At the request however of their leader, they unanimously returned with him to Cusco, in order to support him in his pretensions to that city. Cusco was included in the grant of territory, which had lately been conferred upon Almagro by the court of Spain; but his rival Pizarro, in whose power it then was, could not be persuaded to abandon so rich a possession. Almagro fell in the contest, and his soldiers were scattered over Peru.

Second expedition to Chili under Pedro de Valdivia.

Notwithstanding the failure of the last expedition to Chili, an object so tempting was not thus to be relinquished. Pizarro, now sole master of Peru, was convinced of its importance, and resolved upon another attempt. For this purpose, he commissioned his own quarter-master Pedro de Valdivia, to the exclusion of de Hoz and Carmargo, who had been nominated by the court of Spain. Valdivia had served in Italy, was possessed of courage, prudence, and activity, and, as an officer, was accounted one of the ablest among the Spanish adventurers. Before leaving Peru, he provided himself with all the requisites of a colony, and having crossed the Cordilleras in summer, entered Chili without loss, at the head of 2000 Spaniards, with a large body of Peruvians.

He lays the foundation of St Jago, and dispossesses the Mapochinians.

Almagro had been well received in these northern provinces, chiefly through the influence and authority of his Peruvian confederates. The inhabitants, however, no longer considered themselves as subject to Peru, which they now understood to be itself a conquered kingdom; and they were likewise better acquainted with the Spanish character. It was no longer veiled under the impious and imposing title of divinity. The period of delusion had passed away, and these iniquitous invaders stood naked and exposed in all their startling deformity. The natives were every where in arms to repel the intrusion; and had their power equalled the animosity with which it was exerted, they must have succeeded in the end; but their weapons and their discipline were alike incompetent. Their most powerful efforts were weak, desultory, and ineffectual, and at best served rather to harass than destroy. Unguided and tumultuous, they made but little impression on the steady valour of their more skilful opponents; and the Spaniards, though frequently interrupted, continued their march, and penetrated into the country, as far as the river Mapocho. It was in this rich and beautiful province, that Valdivia resolved, if possible, to effect a settlement. He laid the foundation of St Jago, and immediately erected a strong citadel for its protection. It was not long before this cautious measure proved the safety of the colonists. The Spaniards were resolved to effect in Chili what they had so cruelly accomplished in Mexico and Peru: they had determined to make its free inhabitants the instruments of their avarice, and, in this manner, to subject them to the most degrading servitude. The Mapochinians, therefore, in whose territory they had now settled, and who seem at first to have given but little disturbance to their operations, quickly began to feel the weight of oppression, and, at the same time, to exhibit rather unequivocal symptoms of uneasiness. Upon the first appearance of disaffection, Valdivia seized and imprisoned their chiefs; but the spirit of freedom was not thus to be suppressed, and such insulting severity had the effect only of exciting a more implacable hostility. Seizing an occasion of Valdivia's absence, they effected a general insurrection, assaulted the town, repulsed its defenders, and demolished the half-raised buildings. The Spaniards were now shut up in their fortress; but the enemy fell in thousands around it, and the trenches were soon crowded with their dead. At length the Mapochinians, after a day of gallant exertion, found themselves compelled to retire, both for the purpose of refreshment, and of recruiting their exhausted numbers. In the mean time, Valdivia, secretly apprised of these proceedings, returned in haste to his friends, joined them with sixty horse, engaged the enemy, at the moment they were preparing for a fresh assault, and, after a furious conflict, defeated and pursued them with overwhelming slaughter. The loss of a battle was a misfortune less severe to the Mapochinians, than the murder of their chiefs. This had been effected, during the assault, by the cruel intrepidity of Inez Saurez, a Spanish female, who fearing lest, in the general confusion, they might regain their liberty, and animate their countrymen, dashed out their brains with a hatchet. The spirit, however, of this enduring people, seemed to rise with their misfortunes. Henceforth they renounced every thought of accommodation with their oppressors. They continued for the space of six years with resolute but unavailing perseverance, constantly harassing, but unable to expel the enemy; till at length a feeble remnant, wasted by the unequal contest, and nobly preferring freedom to their country, they destroyed their crops, and took refuge in the mountains.

Distress of the Spaniards; and conspiracy against Valdivia.

The Spaniards, during these transactions, were not without their share of distress. They had been kept almost in a state of perpetual blockade. Their provisions were long since exhausted or destroyed, the supplies constantly intercepted, and the pittance of grain they were able to raise within range of the batteries, proving insufficient for their support, they were reduced often to an extremity of want. Murmuring and discontent were the consequence, and these grew, at length, into a formidable conspiracy, which at once threatened the success of the expedition and the life of its conductor. The plot, however, was fortunately detected, its authors punished with death, and tranquillity restored; while their toils and their dangers were alike quickly forgotten, in the pleasure of an unexpected gratification. An extremely rich mine of gold was discovered and opened in the province of Quillota. This revived their hopes, and dissipated all desire to abandon an enterprise, now of so much promise.

Increasing hostility of the natives.

From the tedious opposition, already experienced, Valdivia was sensible that, without additional forces, it would be impossible for him to pursue those vast schemes of conquest, which he had formerly projected, and still fondly indulged. The more readily to obtain the necessary supplies, he dispatched messengers to Peru, whose spurs, bits, and stirrups were of solid gold. This he hoped might excite expectation, and procure adventurers. Of these messengers, only two, covered with wounds and stripped of their trappings, escaped with difficulty to Cusco: the rest, with an escort of 30 horsemen, were intercepted and slain by an hundred archers of Copiapo. Large reinforcements, however, both by sea and land, were, by the exertions of Monroy and Miranda, the two survivors, sent off to Chili; and these were followed soon afterwards by 300 more, under the command of Francis Villagran, and Christopher Escobar.

Since the affair of Copiapo, the natives had every day become more daring and troublesome: among other instances of this spirit, the Quillotans, by a successful stratagem, had surprised and massacred all the Spanish miners in their district. These proofs of inveterate hostility determined Valdivia, before extending his conquests, to secure what he had already gained; and at the same time to take means of protecting his future communications with Peru. For these purposes, he erected a fort in the province of Quillota, and shortly afterwards proceeding northwards to the mouth of the river Coquimbo, founded, in 1544, the town of La Serena or Coquimbo.

The Promaucians form an alliance with the Spaniards.

Having completed those requisite measures of security, he now turned his thoughts to the long projected invasion of the southern provinces; and next year led his army against the Promaucians. History does not acquaint us with the progress of this interesting contest; we are informed only of its final result; a result which at once tarnished the glory, and annihilated the independence of that brave and once invincible people, which struck out their names from among the patriots of Chili, and drew upon them, ever afterwards, the execrations and the vengeance of their countrymen. They were ultimately seduced into a most inglorious compact with the Spaniards; and Promaucian auxiliaries have, since that period, supported the Spanish interests in Chili.

In the year 1546, Valdivia had pushed his conquests as far as the river Itata. Here, however, a circumstance took place, which, from a want of vigilance on his part, had nearly proved fatal to the whole army, and gave a check to his victorious career. During the night, his camp was attacked and forced by the natives, and the loss was so considerable as to compel a precipitate retreat.

Notwithstanding his late accession of force, Valdivia still found it unequal to his vast designs; and to complete his embarrasment, Pastene, who had sailed for additional reinforcements to Peru, now returned without having accomplished the object of his mission. He brought accounts of the civil war, between Gasca the royal delegate and Gonzalo Pizarro, who resisted his authority. Valdivia hoping to benefit by these commotions, instantly embarked for Peru, with a resolution to join Gasca, and support the royal standard.

In the mean time his rival in Chili, the unfortunate de Hoz, fell a sacrifice to his jealousy. On pretence of aiming at that government, which, as we have before noticed, was legally his own, he was seized and publicly beheaded by Francis Villagran, who was no doubt sufficiently instructed for this infamous proceeding. About the same time a detachment of Spaniards, to the number of 40, was cut in pieces, in their march from Peru, by the inhabitants of Copiapo; and the Coquimbanes, imitating their vigorous example, extirpated the colony of La Serena. This city, however, was quickly afterwards rebuilt by Francis Aguirre.

After the defeat and death of Pizarro, Valdivia returned to Chili, followed by a crowd of adventurers, men of whose seditious turbulence Gasça was happy to be relieved. Before, however, resuming offensive operations, he distributed the conquered provinces among his adherents; and in this manner effectually secured their fidelity, while he inspired them with a more permanent interest, in the country for which they contended. He now penetrated southwards, without almost any opposition, to the bay of Penco; and, according to his usual policy, took possession of the country, by the establishment of a new colony, and the foundation of another city. To this city he gave the name of Conception: it stands on a fruitful soil, and has a fine commercial situation.

Operations against the Araucanians.

From this period we may date the commencement of a more combined, a more vigorous, and a more successful resistance than the Spaniards had yet experienced. A field of more hazardous contention was now opened to them,—a field in which they were not unfrequently to feel the impotence and the pressure of an unrighteous cause. They were now to encounter, not the timid slaves of luxury and prejudice, but a nation of indignant heroes, roused to exertion in defence of their liberty and possessions, who held in defiance their boasted superiority, and set at naught even "the thundering arms of Europe." This new power was the Araucanians, a name bestowed indiscriminately upon several distinct, though confederate tribes: they occupy that portion of Chili which extends between the rivers Biobio and Callacalla. Regarding with indignation the insolence, the rapacity, and the growing power of these formidable strangers, and perceiving that the next blow must inevitably fall upon themselves, the Araucanians resolved to send immediate relief to their neighbours of Penco. For this purpose, Aillavalu, their *Toqui* or dictator, crossed the Biobio, and, at the head of 4000 men, gave battle to the Spaniards. After the first discharge of musketry, the Chilese, by a bold and dextrous movement, pouring at once upon the whole Spanish line, brought it to close fight, while at the same time the Spaniards, having instantly assumed the form of a square, firmly maintained their ground. The conflict was severe and bloody, and for several hours was bravely supported on both sides. At length Valdivia being dismounted, confusion began to shew itself among his troops; when Aillavalu, eager to seize the momentary advantage, by a rash but gallant impetuosity, fell in the front of battle. His soldiers instantly began to retreat, maintaining, however, so much appearance of intrepidity and order, that the Spaniards dared not to pursue. After the battle Valdivia testified his amazement, at the skill, the valour, and the discipline of his new opponents. He had often encountered all the terrors of European warfare, but never before this engagement had his life been put to such imminent hazard. The boldest of his soldiers dreaded the return of so daring an enemy; and, to prepare for the worst, a strong fortification was immediately erected near the town.

In the mean time, the Araucanians were again advancing with a more numerous army than before, but under the auspices of a very different leader. Lyncoyan, the new Toqui, possessed neither the skill nor the courage of his predecessor. His strength and his stature were enormous, and it would seem that a regard to these, more than to his mental abilities, had exalted him to the vacant dignity. The Araucanians, while under his guidance, seemed to have dropped all the energy of their true character, and the succeeding operations were every where marked with weakness, incapacity, and failure. The Spaniards, however, heard of their approach with some degree of alarm, and immediately drew up under protection of their batteries. But they had little to fear from the irresolute temper of their opponent. The first attack proving unsuccessful, he retreated with precipitation, leaving the enemy in equal joy and astonishment. So powerfully, however, were their minds impressed with the magnitude of the danger, and the importance of their sudden deliverance, that these faithless robbers presumptuously ascribed their safety to the miraculous interposition of heaven. During a whole year, employed by Valdivia to enlarge the city, and settle the affairs of his new colony, no molestation was offered by the Araucanians. At length the Spaniards, recovering from their apprehensions, began to ascribe to the fears and weakness of the enemy, what was due only to the misconduct of their leader. Being newly reinforced from Peru, Valdivia resolved to venture an incursion into their territory. He traversed it with unexpected facility, and was permitted, without almost any resistance, to lay the foundation of three other settlements; of Imperial, (1552,) at the confluence of the rivers Damas and Cauten; of Villarica, by one of his officers, at the great lake Lauquen; and of Valdivia, named after himself, at the southern extremity of Araucania. The better to maintain footing in a country of which he now deemed himself the master, he erected a strong fort in each of the most warlike provinces of Puren, Arauco, and Tucapel. He even proceeded so far as to portion out the country and its inhabitants, among his principal officers. After these important operations, Valdivia retired to St Jago, now as much elated with confidence, as he was formerly depressed by apprehension; and having about this time received fresh reinforcements, his ambition began to grasp at still wider dominion. He commissioned Francis Aguirre to subdue the two provinces of Cujo and Tucoman, which lie east of the Cordillera; while he himself entered once more the Araucanian territories, and founded a seventh city in the province of Encol. He called this the city of the frontiers, an appellation which, at an after period, became strictly appropriate.† About this time also, with a view, if possible, by a direct communication with Europe, to render his future supplies independent of Peru, a vessel was dispatched, under the command of Francis Ulloa, to examine the straits of Magellan.

Prosperity thus shone upon the triumphant Spaniards, but a fatal storm was already gathering among the enemy. Submission was equally intolerable and repugnant to the haughty spirit of the Araucanians, and it required but little persuasion to excite them to more vigorous measures. By the exertions of Colocolo, an aged Ulmen, the chiefs were assembled, Lyncoyan deposed, and, after a violent altercation about the supremacy, the choice of a new Toqui was unanimously submitted to the prudent Colocolo. He immediately directed their notice to Caupolican, of a genius at once enterprizing and cautious, but whose modesty had hitherto prevented his appearing as a candidate. A shout of enthusiastic applause proclaimed his election; and scarcely had he assumed the badge of authority, when he had to repress the fiery zeal of his countrymen, who demanded instantly to march in quest of the enemy. After sufficient preparation, he led them against the forts of Arauco and Tucapel, both of which, after a short siege, he forced the Spaniards to evacuate; and, on the ruins of the latter, waited the approach of Valdivia, who was in vain hastening to its relief. The two armies soon met, and the first onset proved auspicious to the Araucanians. The enemy's left wing, pushing forward to meet their

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† Its ruins now stand as a boundary mark between the Araucanian and Spanish territories.

Defeat and death of Valdivia.

attack, was surrounded and cut in pieces. A second detachment fell in the same manner. As the conflict, however, became general, the tide of success was for a while balanced, and began at length to flow heavily against the Araucanians. The Spanish artillery penetrated, with dreadful effect, their compact and crowded battalions. Twice had they been repulsed in disorder, when a third discomfiture completed the confusion, and baffled all the efforts of Caupolican to renew the combat. At this critical moment, the famous Lautaro, a young Araucanian, the captive and page of Valdivia, seized with a patriotic enthusiasm, darted from the hostile ranks, upbraided, rallied, and at length brought his indignant countrymen with such fury to the charge, that the first encounter proved completely decisive; and with such fatal promptitude did he pursue the advantage, that, excepting their general who was made prisoner, not a single Spaniard escaped the slaughter: Only two Promaucians reached Conception with intelligence of the battle. Valdivia condescended to ask his life of the conqueror, promising to quit Chili with all his countrymen; and Caupolican, influenced, as well by his own generous temper, as by the intercession of Lautaro, shewed an inclination to spare him. An old Ulmen, however, more prudent than humane, exclaiming against the folly of trusting to the oaths and the promises of an ambitious adversary, and furious at the thoughts of his escape, secretly approached the prisoner, and dashed out his brains with a blow of his club. A severe punishment would have quickly followed this precipitate conduct, but for the obstinate interposition of the Araucanian officers.

This important victory produced the evacuation of Puren, and the abandonment of Villarica, and the city of the Frontiers. It was celebrated by the Araucanians during three successive days, whilst the heads of their fallen enemies were suspended with savage exultation, around the place of festivity. Lautaro, who, at the early age of sixteen, had thus gloriously achieved the salvation of his country, was created lieutenant-general extraordinary, and entrusted with the command of a separate army; and Caupolican laid siege to Imperial and Valdivia, the only places of strength in Araucania that now remained to the Spaniards.

Francis Villagran succeeds to the government.

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victorious
army.

The accounts of Valdivia's overthrow and death, filled the inhabitants of Conception with the utmost dismay. The instructions being opened, which he had entrusted to the magistrates of that city, it was found that three persons, Alderete, Aguirre, and Francis Villagran, were nominated to succeed him in the government; but neither of the two former being present in Chili, the command devolved upon Villagran. This gallant officer, less intimidated by the late disaster than impatient to revenge and repair it, immediately upon his accession to the government, levied a considerable army, and marched in quest of the Araucanians. In expectation of his approach, and with a resolution to oppose his passage, the young Lautaro had taken a strong position on the hill of Mariguenu. Villagran soon arrived, attacked him with all his forces, and, after a furious and obstinate contest, was at length totally routed. He effected his own escape to Conception with the greatest difficulty, being attended only by a few horse, and leaving on the field of battle the greater part of his soldiers. Not conceiving the town to be at all tenable against the efforts of a triumphant and vigorous enemy, he embarked in haste the old men, women, and children, to be conveyed to Imperial and Valparaiso, and with the remaining inhabitants marched by land to St Jago. Lautaro soon after conducted his victorious followers into the deserted city, and enriched them with its plunder.

During these operations, Caupolican had pressed the sieges of Imperial and Valdivia; but Villagran, being apprised of their danger, and having succeeded in throwing into them sufficient reinforcements, the Araucanian general discontinued the attempt, and with a view to some more important enterprize, united his army with that of Lautaro.

First introduction of the small-pox into Araucania.

About this period, the small-pox, that pestilence to the New World, which a few years before had appeared in the northern provinces, was now for the first time introduced into Araucania, during a predatory excursion from the town of Valdivia, by the Spaniards. Its effects were awfully destructive. One district, in particular, was almost completely depopulated. Of twelve thousand persons, not more than a hundred survived its ravages.

Conception rebuilt, and again demolished, by Lautaro.

In addition to the late misfortunes, the Spaniards were now menaced with a civil war. Francis Aguirre, whose pretensions to the government were superior to those of Villagran, upon information of Valdivia's death, had relinquished his unpromising attempts upon Cujo, and returned to claim the command in Chili. Happily, however, for the colony, the two rivals were induced to submit their pretensions to the court of Audience at Lima. After an expedient to satisfy both parties, by favouring neither, Villagran was, at the petition of the colonies, confirmed in his command; being invested with the more humble title of Corregidor. From the same court, he received instructions to re-establish the settlement of Conception. This he complied with, less from a concurrence in the measure, than from a desire to prove his submission. But he was not suffered to remain long unmolested, in the neighbourhood of so vigorous an adversary. Lautaro met him in the field, with two thousand men, was again victorious, and once more laid in ruins the city and its fortifications.

Lautaro marches against St Jago, and is slain.

While Caupolican resumed the sieges of Imperial and Valdivia, his active lieutenant, at the head of six hundred chosen companions, undertook to employ the enemy in another quarter. He conceived the bold design, by attacking St Jago itself, to strike a blow at the centre of their power in Chili. Immediately he began his march, and penetrated to the river Maulé without offering the least violence to the natives: but the moment he entered the Promaucian territory, he gave a loose to his indignation, and with more justice than policy, took a dreadful vengeance upon these traitorous apostates, whom, by conciliating, he might have recalled, perhaps, from their hated allegiance. He then fortified himself in their territory, in place of marching directly upon St Jago; a delay which proved fatal to the success of the enterprize. The inhabitants were quickly informed of his approach; but, lying at the distance of three hundred miles from Araucania, they at first only ridiculed the information, and could scarcely credit the possibility of so daring an attempt, till it was fully ascertained to them, by the surprise and defeat of one of their detachments. Villagran, being unable himself, from indisposition, to head the forces, gave the command to his son Pedro, with instructions to march directly against the enemy. Pedro attempted in vain to force the Araucanian encampment, and was repeatedly discomfited. A bold stratagem of Lautaro's had nearly overwhelmed his whole army: by turning upon it, during the night, a branch of the river Mataquito. Having escaped this disaster, he soon afterwards laid down the command to his father, who found himself in a condition to resume it. Villagran had now been taught respect for his adversary; and dreading the consequence of a pitched engagement, resolved if possible to take him by surprise. Conducted by a secret path, he reached at day-break the Araucanian camp. At the first alarm, Lautaro, who had just retired from the fatigues of a night's watch, was in a moment at the head of his troops; and, at the same instant, was seen to drop, pierced to the heart by one of the enemy's darts. The exulting Spaniards pressed furiously upon his dispirited soldiers, the meanest of whom would have willingly exchanged fates with his beloved commander, and cared not to survive him. But the triumph was dearly purchased. Not a man of that chosen band would submit to yield himself a prisoner. They spurned at the offered mercy; and after a long and bloody resistance, the few that still remained, despairing to find death, while they continued to deal it so profusely around them, threw themselves on the spears of the admiring and reluctant enemy.

The extravagant rejoicings which the Spaniards manifested on this occasion, and which were continued for three days in succession, throughout all the settlements in Chili, sufficiently testified the importance attached to the victory. Nothing could better celebrate the merits of the young hero, in whose destruction they so exultingly triumphed, and which they regarded as itself a full equivalent for all their disasters. Like Marcellus of Rome, he was the sword of Araucania. His powerful genius supplied the want of experience; and during his short and brilliant career, success never forsook him. The beauty of his person was equal to the energy of his mind. His memory is still fondly cherished, and he is still the boast of his country, as he was formerly its glory and protection.

Don Garcia de Mendoza supersedes Villagran in the command.

Villagran was superseded in command by Don Garcia de Mendoza, who arriving from Peru with a large body of recruits, landed near Conception, (1557), in the small island of Quiriquina. Some of its inhabitants, who pretended to dispute the debarkation, being made prisoners, Garcia commissioned them with offers of peace to the Araucanians. Though Caupolican and the other chiefs were well convinced of the insincerity of this overture, they determined, after some debate, to meet it with a like appearance of candour. From this mode of acting, they proposed to themselves at least one advantage: they hoped to procure information of the designs and power of the enemy. Millalauco was appointed ambassador, and the Spaniards received him with the most splendid military parade. After the conference, which ended, to the disappointment of neither party, in vague offers and general professions, they conducted him, with equal ceremony, through every part of the camp; and, in order to dazzle and intimidate him, their whole strength (what he secretly desired) was laid open to his minutest observation. Upon the return of Millalauco, his countrymen instantly prepared for war.

Defeats the Araucanians, and treats the prisoners with severity.

The first operation of Garcia was the erection of a strong fortress, on the top of Mount Pinto, which commands the harbour of Conception. This the Araucanians in vain attempted to storm;[*] and soon after the Spanish commander, having collected all his forces, crossed the Biobio, and defeated them with considerable slaughter. On this occasion, the cruelty of Garcia to the prisoners was a portentous prelude to his future barbarities. Those of them who escaped with life, were disfigured and mutilated in a shocking manner. Such proceedings, in place of intimidating a warlike people, and hastening their submission,[†] excited only their abhorrence and contempt, and roused even their indignant females to assume the trade of destruction, and, by the side of their husbands, to share, with masculine valour, in the toils and perils of battle.[‡] And though the Spaniards, during the whole of Garcia's administration, maintained a decided superiority, this should rather be imputed to the strength of the Spanish army, the greatest that had yet appeared in Chili, than to the effect of those infamous inflictions. At the battle of Millipuru, which took place soon after the last, the Araucanians, by feats of the most adventurous gallantry, were on the point of obtaining a complete triumph, when their own furious impetuosity saved the Spaniards. A Spanish body of reserve, profiting by their confusion, restored the battle, and secured their defeat. Among the prisoners were six Ulmens, all of whom were sacrificed to the cruel policy of Garcia, and displayed at their execution a magnanimity which should have drawn his esteem and admiration: but the sordid hearts of these tyrants, engrossed only with the schemes of their own selfish ambition, were shut against every manly and generous sentiment; and such, at that period, was the grossness of their depravity, that, to manifest, but for once, a single feeling of human sympathy, a disposition only to alleviate the horrors of oppression, was sufficient to gain for its author the exalted title of humanity.

Garcia having thus given a farther display of his sanguinary temper, marched into the heart of Araucania, and on the memorable scene of Valdivia's overthrow, built and fortified the town of Canete, provided it with a numerous garrison under Alonzo Reynoso, and returned in triumph to Imperial.

Caupolican fails in his attempt upon Canete.

Canete was quickly assaulted by the Araucanians, but with more valour than success. At length, the irritation of defeat and disappointment, drew Caupolican from his usual caution, and made him for once relax from the stern dignity of the national character. In his eagerness to destroy the enemy, he entered into a plot, in which, from a sense of honour, the other chiefs disdained to participate, and which, in its execution, was turned against himself, and proved the destruction of his brave army. A Chilese, one of the Spanish auxiliaries, was engaged to deliver up Canete to the Araucanians. The traitor, however, played a double part. He discovered the whole transaction to Reynoso, who having taken the necessary measures, admitted a part only of the Araucanian forces, overpowered and cut them to pieces; while the cannon of the place, and a charge from the Spanish cavalry, completed the destruction of those without. Caupolican was among the small number that escaped, and with a few domestics took refuge in the mountains. Three Ulmens, taken alive, were blown to pieces from the mouths of cannon.

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[*] "During the attack, Tucapel, an Araucanian chieftain, hurried on by his unparalleled rashness, threw himself, like another Turnus, into the fort, and killing four enemies with his formidable mace, escaped, by leaping over a precipice, amidst a shower of balls."—*Molina.*

[†] "Among the prisoners was one more daring than the others, called Galverino, whose hands Don Garcia ordered to be cut off. He returned to his countrymen, and showing his bloody mutilated stumps, inflamed them with such fury against the Spaniards, that they all swore never to make peace with them, and to put to death any one who should have the baseness to propose such a measure."—*Molina.*

[‡] Hence was probably derived the fable of the Chilian Amazons.

Garcia leads his army through the country of the Cunches, and discovers the Archipelago of Chiloe.

In the confidence that Araucania was now in a state of security, Garcia projected an expedition southwards; and leaving instructions for the rebuilding of Conception, led his army against the Cunches. This people, by the advice of an Araucanian exile, adopted a singular expedient for averting the threatened invasion; an expedient, however, perfectly suited to the sordid temper of their invaders. While the inhabitants concealed their property in the woods, an embassy, fitted out in all the semblance of poverty and wretchedness, was dispatched to meet the Spanish commander. The whole appearance of these ragged messengers, with the present they laid before the governor, while it excited the mirth, repressed the ardour of his soldiers. But Garcia, though himself deceived, encouraged them with the hopes of a happier country beyond this miserable region, and required a guide from the inhabitants. One of the ambassadors undertook this office. In order to support the delusion, he conducted the Spaniards by a rough and desolate route, along the sea coast, and after four days march, having entangled them amidst a desert of precipices, secretly returned to his friends. After surmounting the severest privations, the Spaniards were at length gladdened with the prospect of relief, when, on the 31st of January, they came in sight of the great Archipelago of Ancund, or Chiloe, which lay extended before them. They were saluted by the hospitable natives with a frank and fearless cordiality, and supplied in abundance, and gratuitously, with fish, fruit, and maize. These Islanders had evidently attained some degree of civilization. They were handsomely clothed; agriculture was practised among them, and in some of the islands had made considerable progress: they employed sails, also, in navigating their periaguas. Pleased with the discovery, Garcia returned to Imperial, one of the friendly Chilotes serving as a guide to his army; and in passing through the country of the Huiliches founded, or, according to some, only rebuilt the town of Osorno.

Caupolican taken and impaled.

In the mean time, the illustrious Caupolican was betrayed into the power of Reynoso, and ignominiously impaled. Reynoso, after the infamous example of his superior, had long attempted, by tortures and promises, to procure intelligence of his retreat. A traitor at last appeared among that faithful people. Under his guidance, a Spanish detachment was conducted to the mountains, and surprised the general in the midst of his family. The conduct of Caupolican's wife upon this occasion is remarkable, and affords one example, among many, of that lofty and implacable temper, which has long supported, and still supports, the independence of Araucania. Perceiving that Caupolican, notwithstanding her unceasing exhortation, that he should die rather than surrender, had, after a brave resistance, yielded himself to the enemy, she tossed after him her infant son, with this haughty exclamation, that "she would retain nothing that belonged to a coward."

His son Caupolican the Second succeeds him in the Toquiate.

The Araucanian spirit was effectually roused by the insulting execution of their Toqui. Young Caupolican, who inherited the talents and cool intrepidity of his father, was immediately elected in his room. Twice he defeated the Spaniards under Reynoso, but failed in his attempts upon Imperial, where Garcia commanded in person. The succeeding operations were conducted with various success. Many battles were fought, but with little advantage to either party. At length, Caupolican, perceiving that the enemy were continually strengthened with fresh reinforcements, and himself weakened even by success, determined to prolong the war; and, for this purpose, fortified his army in a position almost impregnable at Quipeo. Here Garcia brought all his troops to the assault. The fierce Araucanians, impatient under a galling cannonade, were soon drawn to a rash and furious sally. The Spaniard saw his advantage, cut off their retreat, and after a severe struggle, which, for many hours, remained doubtful, succeeded in overpowering them. The Araucanians were almost exterminated. The loss of Caupolican, Tucapel, and Colocolo, with most of their bravest chieftains, was the bitter fruit of their temerity. Caupolican, finding retreat impracticable, is said to have perished by his own hands, rather than yield himself a prisoner.

Is defeated at the battle of Quipeo, and puts an end to his life.

It was now concluded, with some appearance of reason, by the Spaniards, that the bold spirit of the enemy was at length completely subdued; but the event once more deceived them. They had still to be taught the supremacy of freedom, of that native enthusiasm, that enduring energy, and that gallant perseverance, which for ever accompany, characterise, and render altogether invincible the efforts of a free and high-minded people. While they were yet exulting in joyful anticipation, a new Toqui was elected by the relics of Quipeo. The few remaining Ulmens, more resolute than ever to maintain their freedom, assembled in a wood, and exalted to the supreme command Antiguenu, a man of low rank, but whose talents entitled him to the preference. He retired, with his little band, to the inaccessible marshes of Lumaco, where it was proposed to concentrate their shattered resources, and strike once more for the deliverance of their country.

Antiguenu elected Toqui.

Reduction of Cujo by the Spaniards.

While these matters were secretly transacting among the enemy, Garcia, finding himself possessed of a large disposable force, dispatched Pedro Castillo for the reduction of Cujo. More successful than Aguirre, he succeeded in establishing in that country the colonies of St Juan and Mendoza. Francis Villagran was about this time reinstated by the court of Spain in his former command, and Garcia, in consideration of his eminent services, was transferred, at the same time, to the government of Peru.

The command restored to Villagran.

Antiguenu defeats the enemy, and lays siege to Arauco.

Antiguenu, when he found himself in a condition to annoy the enemy, sallied from his retreat. Though his first attempts, from the inexperience of his soldiers, were feeble and unsuccessful, he soon taught them to conquer, to confide in their own strength, and in the conduct of their leader; and having obtained some slight advantages over the Spaniards, seized upon the strong position of Mariguenu. Villagran himself, being at this time indisposed, one of his younger sons advanced to dislodge the Araucanians, but lost, in the attempt, both his own life, and the flower of his army. This defeat was followed by the immediate evacuation of Canete and the loss of Villagran, whose death, accelerated by grief, anxiety, and disappointment, was much regretted by the Spaniards, who regarded him as a brave and prudent leader. Pedro his eldest son, respected for the same estimable endowments, was appointed to fill the station of his father. The Araucanians set fire to Canete, and levelled its fortifications with the ground. Antiguenu then undertook the siege of Arauco, with a body of 4000 men, but in order to create a diversion detached a part of them to invest Conception. The siege of Arauco is remarkable for the signal vengeance which this general contrived to obtain upon the Chilese auxiliaries, by whose intelligence his best officers were perpetually marked out, for the aim of the Spanish artillery. By means of secret emissaries, the Spanish commander was made to suspect their fidelity; and in the violence of his displeasure, in spite of all their remonstrances, having driven them from the fortress, would not permit himself to be undeceived, till he beheld the wretched victims of his credulity suffering a cruel death in front of the Araucanians. During the siege also, took place one of those single combats, which about that period had become frequent. Antiguenu challenged Bernal, governor of the fort. The chieftains met mid-way between their respective forces, and after maintaining a sharp conflict for two hours, were separated by their attendants, and returned to their accustomed mode of warfare. The garrison, pressed by scarcity of provisions, and under a strict and vigilant blockade, was at length reduced to extremity, but were generously permitted to withdraw unmolested by the Araucanians.

which is evacuated by the Spaniards.

Antiguenu having in this manner dislodged the enemy from their two principal forts, and delivered the greater part of his country from their oppressions, began to harass them in their own territories. He dispatched Lilemu, a gallant officer, to ravage the provinces of Itata and Chillan, while he marched in person to the siege of Angol. But a period was here put to his victorious career. Whilst encamped at the confluence of the Biobio and Vergosa, his forces were attacked by Bernal, with the whole Spanish army, and totally routed. Antiguenu perished in the flight. Being hurried along with the fugitives, he was precipitated from a steep bank into the river, and there drowned. In this action the Araucanians are said to have employed, with some dexterity, the muskets they had taken at Mariguenu: and the Spaniards entirely owed their success to the resolute temper of Bernal, who, perceiving his infantry every where yielding to the fierce valour of the enemy, charged the fugitives with his cavalry, restored the fight, and thus wrested a victory of which he had begun to despair. The loss of their Toqui was followed by another scarcely less severe to the Araucanians. The brave Lilemu, who, during these events, had been successful in Chillan, fell a glorious sacrifice to his magnanimity. Coming to the relief of a small detachment which had been overpowered by the Spaniards, he seized a narrow pass, and with a few gallant companions, at the expence of their lives and his own, sustained the whole shock of the enemy; while an easy retreat was thus opened and secured for his scattered soldiers.

The Araucanians defeated with the loss of their Toqui.

A weakness consequent upon the late misfortunes, or partly perhaps having its origin in the cautious temper of Paillataru, the new Toqui, gave the Spaniards an opportunity of regaining their possessions. Rodrigo de Quiroga, by whom Pedro had been supplanted in the government, availing himself of one or other of those circumstances, rebuilt Arauco and Canete, raised a new fortress at Quipeo, and laid waste the country.

The following year a company of sixty men under Marshal Ruiz Gamboa paid a second visit to the Archipelago of Chiloe, where, over a multitude of seventy thousand natives, this little band, without one stroke of resistance, was permitted to establish their abhorred tyranny.

Changes in the government.

An extraordinary fluctuation happened about this time in the form of government. In 1565, a court of royal audience was established by Philip II. to which was entrusted the civil and military administration of Chili. This court immediately dismissed Quiroga from his employment, and bestowed the command upon Ruiz Gamboa. Next year, however, on pretence of being inadequate to the purposes of the institution, it was stript of its authority, and the whole power transferred to the person of a single chief, Don Melchor de Brava, with the titles of president of the Royal Audience, governor, and captain general of Chili. The court itself was finally abolished in 1575, when Quiroga was restored to his former authority; but being already advanced in years, did not long enjoy his restitution. At his death (1580) he was again succeeded by Gamboa. During these rapid transitions in the government, many ineffectual though sincere endeavours had been used to bring the enemy to negotiate. The jealous Araucanians, however, continued to avoid, with unconquerable firmness, the slightest advances to an accommodation with a victorious enemy; an enemy whose whole temper and conduct, as well as their avowed designs, served only to excite hostility, and perpetuate disaffection. The war was continued with redoubled animosity. Paillataru was defeated in the neighbourhood of Canete, and the Spaniards, in their turn, under Melchor de Brava, lost another army on the fatal height of Mariguenu.

The Araucanians refuse to negotiate.

After another severe engagement, from which the Spaniards could only claim a victory by remaining masters of the field, the contending powers seemed to have been mutually awed into peace, by the ravages of a tremendous earthquake. Conception was completely demolished, and the other settlements experienced considerable injury. The truce lasted four years, at the expiration of which, on the death of Paillataru, hostilities were renewed. In the election of another Toqui, the Araucanians exhibited some political address. In order to engage the confidence and conciliate the affection of the Mustees, who by that time had exceedingly multiplied in the country, they exalted to the supreme power Paynenancu, one of their number. This chief had served with honour in their armies, and was possessed of courage and activity to a great degree; but his disposition was at the same time rash and presumptuous, and too frequently impelled him to undertakings the most daring and impracticable. He seldom hesitated to engage the Spaniards with inferior forces; and from this cause it was that most of his enterprises, though sufficiently harassing, and often destructive to the enemy, were still more injurious to the Araucanians.* That vigorous and haughty spirit, which had hitherto defied adversity, now manifestly began to flag under a constant succession of defeat and disappointment. In the first years of his command, the Pehuenches and Chiquillanians were persuaded, for the first time, to take a part in the contest, and made inroads upon the Spanish settlement of Chillan. Gamboa, who a few years before under Quiroga established this colony, was now himself at the head of affairs, and the short period of his government was wholly engaged in repelling these incursions, and maintaining the war against Paynenancu.

An earthquake destroys Conception.

He was superseded in 1583 by Don Alonzo Sotomayor, who arrived in Chili with six hundred regular troops. This officer supported the war with a powerful superiority. The impetuous Paynenancu was decisively worsted in three successive engagements, and the Pehuenches expelled from Chillan. But his fame was deeply tarnished by exhibitions of barbarity. He resumed in all its rigour the detested system of Garcia, and even aggravated its horrors by additional inflictions, and more extended ravages. His course through the country was marked with rapine, devastation, and bloodshed. It presented every where a scene of unexampled atrocity; the hamlet yet smoking from the hand of the destroyer; its late happy tenant suspended lifeless or in torture from his chosen

Sotomayor adopts the cruel system of Garcia, and maintains a superiority in his operations against the Araucanians.

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* Soon after assuming the command, he was defeated by the quarter-master Bernal, when several Araucanian females were taken in arms. Most of these preferring death to servitude, or fearing perhaps the brutality of their licentious captors, killed themselves during the night.

tree. Others, by a merciless indulgence, as if to spread still wider the face of calamity, were permitted to escape with life, driven mangled and helpless from their habitations, to stretch forth their mutilated arms, and implore vengeance on the oppressor.

Such iniquitous measures did not fail to raise up new opponents. Mustees, Mulattoes, and even Spaniards, went over to the enemy. In aggravation, however, of their late misfortunes, their little army, consisting of 800 men under Paynenancu, venturing to engage the whole Spanish forces, was cut off almost to a man, and their intrepid leader taken and executed. In this deplorable exigence, extraordinary efforts were exerted to retrieve their sinking affairs. Messengers, with symbolical arrows, were speedily dispersed through the country, and at length succeeded in mustering a respectable force. But the Spaniards still maintained a formidable ascendency. The Toqui Cayencura having lost several engagements, and finding his designs against the fortress of Arauco completely frustrated by another defeat, retired in disgust, resigning the command to his son Nangoniel, who was soon after slain in an ambuscade.

The English make a feeble attempt upon Chili.

At this period, (1586) the English made a feeble effort to supplant the Spanish interests in Chili. Sir Thomas Cavendish, with only three vessels, landed a few troops at the port of Quintero, and began tampering with the natives. He was soon attacked, however, and driven off by the corrigidor of St Jago.

The succeeding Toquis, Cadeguala, Guanaolca, Quintigenu, and Pailaeco, though each could boast of some gallant exploit, were none of them able to expel the enemy. The first fell at Puren in single combat with Garcia Ramon, commander of the place. Guanaolca succeeded in capturing the forts of Puren, Trinidad, and Spirito Santo, but effected nothing more of importance; and the Spaniards were still left masters of the country. The period, however, of this toqui's power, was sufficiently signalised by the retributory valour of Janiqueo, an Araucanian heroine, who, stimulated by the loss of her husband to gird on the sword of vengeance, and, in conjunction with her brother, heading a troop of Puelches, carried devastation through the colonies, and severely harassed the operations of the Spanish army. She was at last, however, entirely defeated on the mountains of Villarica, with the complete dispersion of her followers. Quintiguenu began his short career with all the ardour and expectation of a youthful hero. He carried by assault the fort of Mareguenu. The Spaniards assailed it in turn, and were, for the first time, victorious on that celebrated mountain. The young Toqui performed all that glory could inspire, and perished with the greater part of his army. Pailaeco, like Nangoniel, fell in his first enterprise, not a single Araucanian having escaped the slaughter.

Exploits of Janiqueo, an Araucanian heroine.

Succeeding operations.

Thus after a rapid succession of seven Toquis, none of whom were deficient in courage, and some of them exerting a degree of military energy which merited, and at first seemed to promise a more prosperous event, the Spaniards still maintained possession of the country. Both parties, however, were extremely exhausted, and while the Araucanians, with their new Toqui, returned once more to the marshes of Lumaco, the Spanish commander finding his forces so much reduced, as to render impossible the vigorous prosecution of his advantages without very considerable reinforcements, went in person to Peru, for the purpose of more readily obtaining them. At Lima he met with Don Martin Loyola, commissioned to supersede him. This officer, on his arrival at Conception, was visited by a deputy from Paillamachu, whose true purpose by the message was not merely, as pretended, the formality of congratulation, but, if possible, under that pretence, to discover the views and temper of his new antagonist.[*] The period of Loyola's government was singularly unfortunate. He began his administration by founding (1594) the city of Coya, intended for the double purpose of protecting the mines of Killacoya, and as a place of retreat for the inhabitants of Angol; but he could not save the colonies from the predatory incursions of Paillamachu. This aged Toqui led forth his soldiers, in 1596, to gather subsistence from the enemy's territory, and by the rapidity of his movements eluded all pursuit. He took by storm the fortress of Lumaco, which, in order to repress his excursions, had been erected on the borders of the marsh. Soon afterwards, by one fortunate blow, he redeemed the liberties of his country. Loyola returning from Araucania, had, upon reaching the frontiers, dismissed the greater part of his escort, when Paillamachu came upon him during the night with 200 men, surprised him in his rash security, and slew him with all his attendants. This exploit seems to have been confidently anticipated by the Araucanians, and, by previous concert, was appointed the signal for a general insurrection. Within two days, all the Spanish settlements from the Biobio to the Archipelago of Chiloe were attacked by the enemy, and their cities closely invested. While the victorious Toqui, seizing this moment of surprise and trepidation,[†] crossed the frontiers, took Conception and Chillan, ravaged the provinces, and loaded his troops with their plunder. Notwithstanding, however, the general consternation, Pedro de Viscaza, with what troops he could muster, boldly entered Araucania, and happily succeeded in withdrawing the inhabitants of Angol and Coya. With these he re-peopled the deserted cities of Conception and Chillan. Their apprehensions were considerably allayed by the arrival of Don Francisco Quinones as governor, with a supply of soldiers and military stores. Still, however, the numerous sieges in Araucania were pressed with vigour by the natives, and some indecisive engagements produced the evacuation of Canete and Arauco, while the disappointed Quinones vented all the fury of his unmanly temper on a few wretched captives. Shortly afterwards Valdivia fell into the hands of Paillamachu, who stormed its fortifications, after swimming with his troops across the river. Its capture put the enemy in possession of two millions of dollars, a great number of cannon, with four hundred prisoners.

Paillamachu kills Loyola the governor, and delivers his country from the Spaniards.

In addition to these misfortunes, the Dutch with five ships of war plundered the island of Chiloe, and massacred its garrison. Upon landing, however, on the island of

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[*] The deputy's reply to Loyola, when the latter had indulged himself in expatiating on the vast power and resources of the Spanish monarch, and the ultimate necessity of accommodation on the part of his enemies, affords an evidence of those lofty principles of independence, so ardently cherished by his countrymen. We give it in the words of Molina. "We are not ignorant," said the Araucanian, "of the power of your prince, which extends from east to west. But we are not to be despised; for although we are but a small people, we have hitherto resisted his immense power. Your ideas respecting peace are very different from ours. By peace we understand an entire cessation of hostilities, which is to be followed by a complete renunciation on your part of any pretended right of controul over us, and the restoration of those lands you have occupied in our territories. You, on the contrary, under that name, seek to subject us, to which we will never consent while we have a drop of blood in our veins."

[†] On the first emotions of terror, the inhabitants of St Jago resolved to quit the country, and remove to Peru.

Talea, they were repulsed with loss by the inhabitants, who seem to have mistaken them for Spaniards.

Forbearance of the victorious Araucanians.

These accumulating reverses were quite overpowering to the puny spirit of the governor, and he desired permission, which was granted him, to resign the command. Neither the experience of Garcia Ramon, nor the valour of Rivera, who had signalised himself in the low countries, could retard the fall of Imperial,[*] Villarica, and Osorno.[†] This happened in the course of 1602, under circumstances of extreme privation.[‡] The treatment of the prisoners, who by these successes fell into the power of the Araucanians, affords a noble instance of generosity and forbearance. They were distributed among the inhabitants, and though a few fell into brutal hands, and were treated with severity, not one of them was, according to the example of the Spaniards, either mutilated or impaled. The married were in general allowed to retain their wives, while others had permission to unite themselves to the females of the country: and when an exchange of prisoners took place, some of them who had families preferred remaining with their captors. Such was the conduct of a people, who, by acts of the most ferocious barbarity, had been too frequently provoked to retaliate, and who, in that instance, possessed the full means of retribution.

The Spanish army cut in pieces by the Toqui Huenencura.

The misfortunes of the Spaniards did not cease with the life of Paillamachu, who died at the close of the year 1603. Garcia Ramon, upon his second succession to the command, having been largely reinforced, entered Araucania at the head of three thousand regular troops, besides auxiliaries; an army which was fondly regarded by the colonists as the certain means of re-establishing their tyranny, and wiping out the stain of their calamities. He constructed a fortress in the province of Boroa, which, however, the garrison was shortly compelled to evacuate. The Spanish army then commenced its ravages in two divisions; these were separately attacked by the Toqui Huenencura, and with such admirable dexterity and overpowering success, that he destroyed or captured them to a man.

Re-establishment of the court of Royal Audience.

Induced by these repeated disasters, the court of Spain decreed a permanent establishment of two thousand regular troops to be maintained on the frontiers; and in 1609, after its suppression for thirty four years, restored the Royal Audience. Garcia once more crossed the Biobio, and somewhat retrieved the disgrace of his late overthrow by defeating the Araucanians. He died soon afterwards in the town of Conception, regretted by the Spaniards, and respected even by the enemy for his honour and humanity. Huenencura did not long survive him. The succeeding Toqui Aillavalu the second, has been ranked among the greatest of Araucanian generals, but his fame has outlived the memory of his exploits.

Negotiations for peace

In the year 1612, in consequence of the complaints of Luis Valdivia, a Jesuit missionary, who zealously represented to the king the impracticability of propagating religion amid the tumult of arms, great exertions were made, on the part of Spain, to accomplish a treaty. Philip III., a bigotted though devout monarch, issued commands for a suspension of hostilities, and commissioned Valdivia with full powers to negotiate a peace. Aillavalu, suspicious of the enemy, paid little regard to their professions. But his successor Ancanamon, after minute inquiries, entered sincerely into proposals for an accommodation. The conditions proposed were these, "That the Biobio should serve as a barrier to both nations, so that neither should be permitted to pass it with an army; that all deserters, in future, should be mutually returned; and that the missionaries should be permitted to preach the doctrines of Christianity in the Araucanian territories." After the execution of the required preliminaries, and when the treaty was on the point of being finally concluded, the whole proceedings were completely overturned by the obstinate bigotry or the interested opposition of the Spanish officers. One of the Toqui's wives, a Spanish lady, whose detention in that capacity had been compulsory, seizing the occasion of her husband's absence, fled to the governor with two small children. Ancanamon vainly demanded their restoration: his claim was rejected by a majority of officers. He then claimed his two infant daughters, for whom he bore the fondest attachment; but of these also the eldest was denied him, on the plea that she had been converted to Christianity, and might be in danger, in a pagan country, of receding from the faith. In the mean time the Ulmen of Illicura had, from motives of gratitude to Valdivia, engaged to facilitate the negotiation, and at the same time received some missionaries into his province. The exasperated Toqui, who had now abandoned all desire of peace, no sooner was informed of this proceeding, than he hastened with a party of two hundred horse to Illicura, and immediately slew the missionaries with their protector. All attempts to revive the negotiation were fruitless.

Hostilities renewed.

Thus frivolously was rekindled a war, which, in its course, had already drained Araucania of its bravest inhabitants, and drenched its fields with the best blood of the enemy. Ancanamon poured out his indignant vengeance on the Spanish provinces, and some severe engagements followed. But the levity of the Spaniards received its full measure of retribution, during the dictatorships of Lientur and Putapichion. The ardent genius and enterprising spirit of Lientur carried every thing before him. His expeditions were a succession of triumphs to his country, and of discomfiture and humiliation to the Spaniards: he retired with glory in his old age, regarded even by his enemies as the darling of fortune. He was succeeded by Putapichion, a leader possessed of talents scarcely inferior, though less uniformly triumphant, but whose laurels were shamefully polluted, by reviving, happily but in one instance, the cruel ceremony of the pruloncon or dance of the dead.[§] He fell gloriously, in a bloody engagement with the Spanish governor Don Francisco Laso, and in the moment of success; but his soldiers, intent only to remove the body of their leader, permitted the enemy to rally his dismayed battalions, and lost a victory which their valour had in part achieved. The death of Putapichion threw a superiority on the side of the Spaniards. His successors in the Toquiate, with equal ardour to annoy the enemy, were deficient in those qualities, which could alone secure its accomplishment. Their efforts, though not always ineffectual, seem in general to have been the result rather of temerity than of skill. They have the just praise, however, of having been sincere in the great cause of their country, and their sincerity was sealed with their blood. In the course of a very few years Araucania was deprived of five successive Toquis, and, during that period, was frequently exposed to severe ravages from the governor.

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[*] The capture of this city was greatly protracted by the active intrepidity of Ines Aguelera, who, after losing her husband and brother, conducted the defence in person. She escaped with part of the inhabitants; and the king rewarded her valour by an annual pension of two thousand dollars.

[†] According to an account addressed to the court of Chili, (1774) by Don Ignatius Pinuer, the Spanish garrison of Osorno retired to a peninsula formed by a lake at the south foot of the Andes, where they built and fortified a city, and were known to the Indians by the name of Alcahuncas. Of this establishment the officers are said to have become the tyrants, and used the strictest precautions to prevent intelligence of its existence being carried to any of the Spanish settlements; and in this they were actively seconded by the surrounding Indians.

[‡] "The garrisons," says the Abbé Molina, "were compelled to subsist on the most loathsome food; and a piece of boiled leather was considered as a sumptuous repast for the voluptuous inhabitants of Villarica and Osorno."

[§] It was the custom of this barbarous festival to sacrifice one of the captives to the manes of the soldiers slain in battle. A minute description of the ceremony will be found in the article ARAUCANIA.

Expeditions of the Dutch and English against Chili.

The Spanish settlements were again threatened by the Dutch and English. The first arrived upon the coast in 1638, when a storm frustrated their enterprise, by the dispersion of their little squadron. Some years after, the English fleet, on its way to Chili, under Sir John Narborough, was lost in the straits of Magellan.

A peace concluded between the Araucanians and Spaniards.

Laso, like some of his predecessors, had engaged his promise to terminate the war with the Araucanians, but notwithstanding his utmost endeavours, and the vigorous ability with which these were exerted, they still obstinately maintained their freedom; and he was at length reduced to the necessity of soliciting reinforcements. Instead of these, however, the court of Spain sent out the Marquis de Baydes to displace him from the command. De Baydes, immediately on assuming the government, (1643,) opened a conference with the Toqui Lincopichion; and the two chiefs, entertaining similar views, a peace was concluded on the 6th of January, the following year, upon the terms proposed to Ancanamon, but with this further requisition, that the Araucanians should not permit the landing of any strangers upon their coast, nor furnish supplies to any foreign nation whatever. This prudent stipulation proved shortly of the highest importance to the Spaniards.

The Dutch frustrated in their last attempt to dispossess the Spaniards.

In 1643, the Dutch, after the reduction of Brasil, renewed their attempts upon Chili; but this their last effort, though apparently more formidable and better concerted, was not more successful than the two former. They possessed themselves of the deserted harbour of Valdivia; and the Araucanians were in vain solicited with the most pressing invitations to break with their ancient enemy. Not only, however, did they remain faithful to their engagement, but readily united with a Spanish army to expel the strangers. Upon intelligence of their approach, the Dutch, greatly oppressed for want of provisions, found themselves once more compelled to abandon the enterprise.

Rupture with the Araucanians.

In 1655, hostilities were excited afresh during the government of Don Antonio Acugna; but from what cause, or which party was the aggressor, we are not informed. The Toqui Clentaru, in his first enterprize, had the glory of annihilating a Spanish army. He then cleared the country of some remaining fortresses, crossed the Biobio, and after defeating the governor, overturned the forts of St Christopher and the Eustacia del Rey, and burned the city of Chillan. Don Francisco Meneses brought the war to a termination in 1665, by a peace which lasted forty-eight years. During this period little occurred deserving particular notice. A slight rebellion took place among the inhabitants of Chiloe; which, however, was quickly suppressed by the prudent exertions of Don Pedro Molina. During the war of succession in 1707, the external commerce of Chili fell into the hands of Frenchmen, and remained wholly under their management till 1717. Many of them settled in the country, and have left numerous descendants.

The war of 1723 menaced the Spaniards in its commencement with total expulsion from Chili. It appears to have been excited by some encroachments on their part, and by the insolent aggressions of those persons styled *Captains of the Friends*, (Spanish officers placed in Chili for the ostensible purpose of protecting missionaries). The assumption of powers which did not originally belong to them was deeply resented, and soon stirred to a flame the watchful jealousy of the Araucanians. Villumilla was elected Toqui in 1722. His first aim was to engage the co-operation of all the Chilians, that by one sudden and overwhelming effort he might sweep the Spaniards from every province of the country. But though his measures to this effect were taken with vigour, secrecy, and precision, its accomplishment was entirely frustrated, by the inaction of the conquered Chilians. The long and rigid despotism which had been exercised over them with such barbarity by the Spaniards, had not only repressed the population, once numerous and flourishing, but reduced it to a spiritless remnant. The small number therefore, and the broken spirit of these injured and degraded beings, should perhaps exculpate them from the charge of cowardice. On the day appointed, the signal fires served only to remind them of ancient freedom, without exciting a single effort to regain it. Villumilla, thus disappointed of extensive co-operation, though he was not deterred from attacking the enemy, accomplished nothing of importance. He succeeded in taking several fortresses; but the governor, Don Gabriel Cano, who had entered Araucania with an army of 5000 men, not choosing to attack him, the war was reduced to skirmishes, and soon afterwards terminated by the peace of Negrete.

The interval of tranquillity was occupied by a succession of governors, in forming new establishments, and peopling them with great numbers of their countrymen, at that time scattered over the provinces. An attempt to extend the same policy, with very different views, to Araucania, produced a rupture with that vigilant people, who, regarding cities as the emblems of servitude, and with extreme aversion, could not be persuaded to adopt a measure which might one day prove instrumental in subverting their liberties. The subsequent war, however, of which we have no particular account, compelled the Spaniards to forbear even such indirect methods of reducing a warlike nation, resolved to remain independent, or to perish with its freedom. The peace which followed in 1773, was a confirmation of the treaties of Quillin and Negrete. During the negotiations which, at the desire of the Toqui Curignancu, were held in St Jago, a demand, rather unexpected, was made from the same authority. It was required, that henceforth the Araucanians should be permitted to keep a minister resident in that city. This also, notwithstanding the opposition of his officers, the governor thought proper to concede, and every obstacle being removed, the terms were adjusted and ratified on the bases of the preceding treaties.

Since their last expulsion from Araucania the Spaniards have prudently abstained from any further attempts to regain their possessions in that warlike province; the preservation of which had already been attended with so much hazard and bloodshed. In 1792 the colony was in a flourishing state under Don Ambrosio Higgins, a native of Ireland, who increased the number of its cities, extended its commerce and fisheries, encouraged its agriculture, and by the whole of his able and useful admini-

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stration became the object of universal regard. Since that period no intelligence of interest or importance has been received from Chili, except the general fact, that with the other Spanish colonies in America, it has withdrawn its allegiance from the present government at Cadiz, while it acknowledges Ferdinaud VII.

Part II. STATISTICAL ACCOUNT OF CHILI.

Statistics.

General geography.

Chili is bounded on the north by Peru, on the south by the land of Magellan, on the west by the Pacific Ocean, and on the east by Tucoman Cujo and Patagonia. The natural limits of Chili on the land side are the Andes or Cordillera and the desert of Atacama. It is to be remarked, however, that not only the western vallies of the Andes, but also the eastern, which have been occupied from time immemorial by Chilian colonies, make an integral part of the country. In length it has been computed at 1260 geographical miles. Its greatest breadth, which is near the Archipelago of Chiloe, is about 300 miles. Between the 24th and 32d degrees of latitude, in a direct line from the coast to the mountains, it measures about 210, and its narrowest part from the 32d to the 37th, not more than 120 miles. It contains a surface of 378,000 square miles.

Origin of the name.

Among the various whimsical derivations of the name of Chili, that suggested by the inhabitants is, perhaps, the least absurd. They derive it from the note or cry of one of their birds, which in its utterance somewhat resembles the word Chili; and "it is not improbable," says Molina, "that the first tribes who settled there, considered this note as a good omen, and named the country accordingly."

Aspect and natural divisions.

Chili presents a plain, gradually rising in elevation as it recedes from the coast and approaches the Cordillera. From this sloping conformation it is fertilized and beautified by innumerable rivers, which having their source in the mountains, cross the country from east to west, and discharge themselves into the Pacific Ocean. The natural divisions of Chili are three in number; Chili Proper, the country of the Chilian Andes, and the Islands. *Chili Proper*, comprehended between the Andes and the sea, and measuring in breadth at least 120 miles, has been divided into two equal portions, viz. the Maritime and Midland. Three chains of mountains, parallel to the Andes, intersect the Maritime country. The Midland portion is almost an uniform plain, interspersed only with a few solitary hills. That portion of the *Andes* which belongs to Chili, is about 120 miles in breadth. It contains a vast number of contiguous and very lofty mountains, and in its various scenery exhibits often the most striking features of the grand, the picturesque, and the beautiful. The *Islands* that belong to Chili are the Coquembanes, Mugillon, Totoral, and Pajaro, which remain desert; Carama, which is a mere rock and scarcely worth notice; the two islands of Juan Fernandez, Isola di Terra (the shore islands), and Masafuera (the more distant), both of which are beautiful and inviting, but the first only (Isola di Terra), which is the largest, is inhabited by a few Spaniards; Quirequina and Talca, or Santa Maria near Conception; Mocha, on the coast of Araucania, which is more than 60 miles in circumference, handsome, and fertile, but deserted by the Spaniards; the Archipelago of Chiloe, which, with that of the Chones dependent upon it, comprehends eighty-two islands, at present occupied by Spaniards and Indians. Chiloe, the largest of these, is in length about 150 miles, and gives its name to the Archipelago. All the above islands, except those of Juan Fernandez, are situated near the coast.

Chili Proper.

The Andes.

Islands.

Political divisions.

Chili may be divided politically into two parts; the conquered portion, in possession of the Spaniards, and the Indian part, which still maintains its independence. Spanish Chili extends from the 24th to the 37th degree of south latitude, and is divided into thirteen provinces, which we here subjoin, beginning from the north, with a short statement of their extent, productions, and capitals. *Copiapo*, stretching from the Andes to the sea, is in length 100 leagues by 70 in breadth. Its northern part is chiefly inhabited by hunters of the vicugna. This province contains mines of lead and silver, and abounds in gold, lapis lazuli, and fossile salt. Copiapo, the capital, is situated on a river of the same name, in 27° 10′ south latitude, and in west longitude 71° 5′ 15″. Copiapo, extending also from the Andes to the sea, is 70 leagues from north to south, and 45 from east to west. The soil is fertile, producing abundance of grapes, olives, and other fruit, both native and European. It is rich in gold, copper, and iron. Its capital, Coquimbo, or La Serena, stands in south latitude 29° 54′ 40″; west longitude 71° 19′ 15″. *Quillota*, lying on the sea-coast, is 25 leagues in length, and 21 in breadth. This province is one of the most populous in Chili, and is particularly abundant in gold. The capital, named Quillota, or San Martin, is in south latitude 32° 42′, and west longitude 71°. *Aconcagua*, is an inland province, comprehending part of the Andes; 75 leagues in length, and the same in breadth. It is fertile in grain and fruit; produces excellent copper, and contains the rich silver mines of Uspalata. The capital, Aconcagua, or San Filipe, is situated in lat. 32° 18′, and long 69° 55′. *Melipilla*, on the sea-coast, measures 11 leagues from north to south, and 23 from east to west. It is a beautiful and fertile province, abounding in wine and grain. Melipilla, or San Joseph de Lagrano, the capital, is finely situated on the river Maypo, in lat. 33° 36′, long. 70° 42′. *Santiago*, near the Andes, is a small province, measuring only 11 leagues from north to south, and 20 from east to west; it is, however, extremely fertile, and abounds in grain, wine, and excellent fruits, especially peaches. Capital, St Jago, in lat. 33° 16′, long. 69° 48′. *Rancagua*, extending from the Andes to the sea, is 40 leagues from east to west, and 13 from north to south. It is fruitful in grain, and has a rich mine of gold in the vicinity of Alque. The capital, Santa Croce de Trianna, or Rancagua, lies in lat. 34° 18′, long. 70° 16′. *Calchagua*, reaching from the Andes to the sea, is from east to west 43 leagues, from north to south 15. This is a rich province, abounding in grain, wine, fruits, and gold. San Fernando, the capital, is in lat. 34° 36′, long. 70° 34′. *Maulé*, extending from the Andes to the sea, is 44 miles from north to south, and from east to west 48. It abounds in grain, wine, fruits, cattle, fish, salt, and gold. Several noble families, whose finances had been much reduced, having retired to this province, it has, from that circumstance, received the appellation of the Bankrupt Colony. It contains many villages of native Chilese, and one in particular, *Laro*, inhabited by Promaucians, and governed by a native chief or Ulmen. Capital Talca, or St Augustin, in south lat. 35° 18′, west long. 70° 48′. *Itata*, on the coast, 11 leagues from north to south, and 23 from east to west. It affords the best wine in Chili, known by the name of Conception wine, from its being produced on

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Spanish Chili, with a description of its provinces.

lands belonging to inhabitants of that city. The capital, Coulemu, or Nombre de Jesus, is situated on the Rio Jesus, in south lat. 35° 58′, west long. 72° 38′. *Chillan*, an inland province, near the Andes, 12 leagues from north to south, and 25 from east to west. Its plains being considerably elevated, afford excellent pasture for sheep, whose wool is reckoned of a superior quality. The capital is Chillan, or San Bartholomew, in south lat. 35° 54′, west long. 71° 30′. *Puchacay*, on the sea-coast, 12 leagues from north to south, and 25 from east to west. The soil of this province is fertile, and the climate always temperate. It produces the largest strawberries in Chili, and abounds in gold. Conception, in south lat. 36° 49′ 10″, west long. 73° 5′, is the principal city, though the corregidor resides in Gualqui. *Huilquilemu*, more generally named Estanzia del Rey, lies near the Andes, and is 12 leagues from north to south, and 25 from east to west. This province has mines of gold, and produces excellent wine, resembling Muscadel. The capital is Huilquilemu. *Valdivia*, now used only as a military station, is completely separate from the other Spanish provinces, and encompassed by the territories of the Araucanians. The capital, Valdivia, is situated at the bottom of a secure bay, whose entrance is commanded by the island Manzera.

All the above provinces, excepting Valdivia, were anciently possessed by the Copiapins, Coquimbanes, Quillotanes, Mapochinians, Promaucians, Cures, Cauques, and Pencons. But most of these once flourishing tribes are now extinct, and the few that survive have been wasted to a miserable remnant, by the oppressive tyranny of the Spaniards.

The independent provinces. That portion of Chili which still maintains its independence, lies between the 36th and 41st degrees of south latitude, extending from the Biobio to the Archipelago of Chiloe. It is at present occupied by three independent nations, the Araucanians, the Cunches, and the Huilliches. *Araucania*, extending from the Biobio to the river Callacallas, contains the finest plains of Chili. It is in length 186 geographical miles. Its original breadth was 300, but in the 17th century it was augmented to 420, by the junction of the Puelches, who inhabit the western side of the Andes. The united territory is computed at 78,120 square miles. It is divided into four parallel principalities, termed *Uthalmapu*, which are distinguished by the following descriptive appellations: Lauquenmapu, or the maritime country; Lelbunmapu, or the plain country; Inapiremapu, or the country at the foot of the Andes; and Piremapu, or the country on the Andes. These are each of them divided into five provinces, which are again subdivided into nine districts.* Between the river Callacallas, and the Archipelago of Chiloe, is comprehended the territories of the Cunches and Huilliches, who are both allies of the Araucanians. The Cunches occupy the part extending along the coast; the Huilliches inhabit all the plains to the eastward, between the Cunches and the main ridge of the Andes.

Mountains. The highest of the Chilian Andes are, the Manflos, in south lat. 28° 45′; the Tupungato, in 33° 24′; the Descabezado, in 35°; the Blanquillo, in 35° 4′; the Longavi in 35° 30′; the Chillan, in 36°; and the Corcobado, in 43°, all of which are said to be more than 20,000 feet above the level of the sea. The most remarkable of these is the Descabezado, whose summit presents a plain of more than six miles square, having in the middle a very deep lake. This lake is supposed to have been at one time the crater of a volcano. In height, it is probably not inferior to the celebrated Chimborazo of Quito. Between the 24th and 33d degrees of south latitude, the Andes are wholly desert. From this to the 45th, they are occupied by Chilian colonies, under the general name of Patagonians, but whose different tribes are likewise known by the separate appellations of Chiquillans, Pehuenches, Puelches, and Huilliches.

Rivers. Chili is watered by a vast number of rivers, which proceeding westward from the Andes, discharge themselves, by fifty-two mouths, into the Pacific Ocean. The principal of these are, the Maule, the Biobio which is two miles in breadth, the Cauten, the Tolten, the Valdivia or Callacallas, the Chaivin, the Riobueno, and the Sinfondo, which, with some others, are navigable for a considerable extent to ships of the line. Their course is very rapid till they reach the maritime Mountains, where it is retarded by the nature of the ground. They swell to their greatest height about the end of September, when it has been remarked that some of them rise most in the morning, others at mid-day, and others towards evening. At no time, however, do they so much overflow their banks as to lay the adjacent plains under water.

Lakes. The lakes of Chili are of two kinds, the salt and fresh water lakes. Of the former are the lakes of Bucalemu, Caguil, and Bojeruca, situated in the marshes of the Spanish provinces. Those of fresh water belong to the inland provinces; they are the Redaguel, the Aculeu, and the Taguatagua; also the Lauquen and Nahuelguapi, in Araucania, the first of which has a beautiful cone-shaped hill rising from its centre, and is the source of the river Talton. The Nahuelguapi is 80 miles in circumference, has a pleasant island, and gives rise to a river of the same name, which falls into the Patagonian sea.

Towns. The towns of Chili are built in the finest parts of the country, but not always placed so advantageously as they might have been, for the purposes of commerce. The streets are about 40 feet wide, intersecting each other at right angles, and forming so many squares. The houses in general are built of mud or clay hardened in the sun, having but one storey, with a garden attached to each of them; many, however, of more recent construction, are composed of brick or stone, and furnished with upper stories. In our sketch of the provinces, we have already mentioned the principal cities; but we shall here notice more particularly some of the most remarkable. *St Jago*, the capital of the Spanish provinces, was founded in 1541, by Pedro de Valdivia, and is finely situated on the left bank of the river Mapocho, in a beautiful plain 24 leagues in extent; it stands 90 leagues from the sea, and 20 from the main ridge of the Andes; the river is employed in watering its numerous gardens, and is conveyed through the streets by means of conduits. The principal suburbs lie on the opposite bank of the river, and a fine bridge connects them with the city. The houses of St Jago, though very low, and in general but of one story, are both handsome and convenient. The grand Piazza, near the middle of the city, is 150 feet square, having an elegant bronze fountain in its centre. The inhabitants, in 1770, were computed at 46,000. *Conception*, or Penco, was founded by Valdivia, in 1550; but being twice overwhelmed by an earthquake, accompanied by an inundation of

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* The names of these provinces and districts are given in the article ARAUCANIA.

Statistics.

the sea, its first situation was abandoned for one more secure, and the city was rebuilt (1764) about a league from the shore. It contains about 13,000 inhabitants. The bay of Conception is the largest on the coast of Chili, and has two entrances formed by the Island Quiriquina at its mouth, the east of which is the safest and most frequented. Its best port is that of Talcaguana. *Coquimbo*, or La Serena, founded by Valdivia in 1544, presents a beautiful appearance, the wide spaces between its squares being entirely occupied by gardens; the houses are built of mud, covered with leaves. It is a large town, but not proportionably inhabited. *Valparaiso*, the principal sea-port in Chili, from whence is transacted all the trade with Peru, is large, populous, and flourishing. It lies about three miles from the port; but there is another town called Almendral, close upon the harbour, which is the residence of those employed about the shipping. The harbour is capacious, and sufficient to contain large vessels up to the shore. Valparaiso has a military governor, or corregidor, nominated by the king.

Forts.

The principal forts have been erected on the southern frontiers, to repress the incursions of the Araucanians. On the north side of the Biobio, are the forts of Jumbel. Tucapel, Santa Barbara, and Puren. To the south of the same river is the fort of Arauco, with those of Colcura, San Pedro, Santa Joanna, Nascimento, and Angeles.

The Araucanians have neither walled cities, nor permanent fortifications of any kind; but regarding these as emblems of slavery and dependence, they reside in scattered hamlets, which are commonly situated on the banks of rivers, or on plains that possess the convenience of an easy irrigation.

Soil.

The inland parts of Chili are the most fertile, and the fertility increases in proportion to the distance from the sea. The vallies of the Andes are superior to the middle districts, and these to the maritime. In the maritime districts the soil is brown inclining to red, brittle, and clayed, and contains marl mixed with marine substances. In the interior, and in the vallies of the Andes, it is brittle, and of a yellowish black colour. It every where possesses an extraordinary warmth, and brings to perfect maturity those tropical fruits which are natives only of the torrid zone. The inexhaustible sources of fertility in this delightful country, renders unnecessary the use of artificial manures, and experience has taught the husbandmen of Chili their superfluity, if not injury. The fermentation and putrefaction of manure is supposed to engender or multiply certain worms destructive to grain in the blade. From these Chili is entirely exempted; and it is alleged as a known fact, that the lands of St Jago, though they have been constantly cultivated for a period of near two centuries and a half, without receiving any artificial manure, have suffered no diminution in their amazing produce. The soil of Chili, by a very moderate calculation, yields, at an average, 65 for one in the middle districts, and 45 in the maritime. There are, indeed, lands which produce 120, and 160 for one; and, according to some authors, there have been frequent instances of 300 fold; but this extraordinary increase has not been confirmed by later and more authentic information.

Climate.

The climate is mild, equable, and salubrious, and not inferior to any in the new world. The transition from heat to cold is moderate, and their extremes equally unknown. The air is so much cooled in summer by certain winds from the Andes, distinct from the east winds, that in the shade no one is even incommoded with perspiration. In the interior where the heat is greatest, Reaumur's thermometer seldom exceeds 45°, and in winter it very rarely sinks below the freezing point. Chili enjoys a constant succession of fine weather from the beginning of spring till autumn. The rainy season commences in April, and continues to the end of August. The southern provinces have much more of it than those in the centre, while in the northern provinces of Coquimbo and Copiapo it rains very seldom. In these provinces, however, and throughout the country, the dews fall in such abundance, as in a great measure to supply the want of rain. Snow, except on the Andes, is very uncommon. On the coast it is entirely unknown, and though it sometimes falls in the middle districts, it is often melted before reaching the ground, and is seldom known to lie for the space of a day. On the Andes, however, from April to November, it falls in prodigious quantities, and renders the passes for the greater part of the year altogether impracticable.

Winds.

The winds in Chili are considered as infallible indications of weather, and serve the inhabitants for a barometer. The southerly winds proceeding directly from the Antarctic pole, are cold, attended with fair weather; the northerly winds, on the contrary, are hot and humid, and usually bring rain. In the provinces of Cujo and Tucoman, they are more suffocating than the Siroc in Italy; but in crossing the snowy summits of the Andes to Chili, their noxious properties are in a great measure removed or qualified. The south wind prevails while the sun is in the southern hemisphere. It begins to relax about noon, and is then supplanted for two or three hours by a fresh breeze from the sea, which, from the regularity of its returns, is called the twelve o'clock breeze. The south wind returns in the afternoon, and at midnight is once more succeeded by the western breeze. The east wind is seldom felt in Chili; and there exists but one instance of a hurricane.

Meteors.

Meteors, especially shooting stars and balls of fire proceeding from the Andes to the sea, are very frequent in Chili. The aurora australis seldom appear. One of the largest of these phenomena happened in 1640, and remained visible from February to April.

Volcanoes

Among the vast number of volcanoes in the Cordillera, there are fourteen in a state of perpetual combustion, all of which belong to Chili, and are situated near the middle of the Chilian range: the lava and ashes discharged from them never fall beyond the limits of the Andes. Only two volcanoes are found among the maritime and midland mountains; one at the mouth of the river Rapel, which is small, and emits at intervals only a little smoke; the other is the great volcano of Villarica, distinguishable at the distance of 150 miles, and said to be connected by its base with the Andes. It continues burning without intermission, but its eruptions have seldom been violent. The base is covered with forests, and its sides with a lively verdure. The most remarkable eruption of the Chilian volcanoes was that of Peteroa, in the 3d of December 1760, when the volcanic matter opened for itself a new crater, and a mountain in the vicinity suffered a disruption to the extent of several miles. A large portion of the mountain fell into the Lontue, and having filled its bed, a lake which still remains was thus formed by the overflowing of the river.

Earthquakes.

Chili, so highly favoured in other respects, is rendered, by its quantity of inflammable matter, extremely subject to earthquakes. There are, however, two of its provinces which would seem to be almost totally exempted from their influence. It is a remarkable fact, that while other parts of the country have been violently agitated, the shock, if felt at all, was but slightly perceptible in Copiapo and Coquimbo: this some have attributed to the supposed existence of certain large subterraneous caverns intersecting these provinces, which, by affording vent to the inflamed substances, may thus suddenly arrest the progress of the convulsion. It is a very great alleviation of this tremendous scourge, that its approach is invariably announced by certain hollow sounds, the effect of a vibratory motion in the atmosphere, which give the inhabitants warning to quit their houses, and take refuge in the streets, courts, and gardens. Happily the streets are of such a breadth as to afford a safe retreat, though the houses on each side should fall to the ground. Only five considerable earthquakes have occurred in Chili since the arrival of the Spaniards to the year 1782, a period comprehending 244 years. The first in 1520, and the second in 1645, were attended with no very serious injury. The third, which took place on the 15th of March 1657, overturned a great part of St Jago. The fourth, on the 18th of June 1730, produced an inundation of the sea, which beat down the walls of Conception. The fifth, on the 26th of May 1751, was immediately preceded by slight shocks, and the appearance of a ball of fire darting from the Andes to the sea. It completely overwhelmed Conception, and destroyed all the fortresses and villages between the 34th and 40th degrees of latitude. Its course was from north to south, and slight tremblings, with intervals of fifteen and twenty minutes, were experienced for the space of a month after the earthquake.

Physical organization. Various marine substances are to be found almost in every part of Chili, and on the tops even of its loftiest mountains. In the main ridge of the Andes, the external form of the mountains is that of a pyramid, covered in some instances with conical elevations. Their internal structure consists of large primitive rocks of quartz, differing very little in general configuration. The maritime and midland mountains, together with the lateral chains of the Andes, are of secondary formation, and, in their structure, differ essentially from those of the main ridge, which are primitive: they rise abruptly from the base; their summits also are more rounded; and their strata, which are horizontal and of unequal thickness, abound with marine productions, and contain the impressions of animals and vegetables. These secondary mountains are in general stratified, containing a large variety of minerals, and covered with a deep soil and plentiful vegetation. Some of them, however, are homogeneous, all of which are barren, and exhibit on their surface only a few languid shrubs. Of the homogeneous mountains, some are composed entirely of shells, others of gypsum, of granite, of quartz, of freestone, of basalts, of lava, and some are calcareous. The organization of the vallies is similar to that of the stratified mountains. **Caverns.** The maritime mountains present on their western declivities many curious excavations or grottos, all beautifully hung with shells and spar. These caverns are also very numerous in the Andes. The most remarkable of them is that near the source of the river Longavi, which, immediately before sun-rise, exhibits to the spectator a very unexpected phenomenon; the rays, penetrating the cavern by some hidden aperture, reach his eye before they have yet tinged the summits of the Cordillera. In the same range also may be seen, a large mountain of gypsum, perforated quite through by the river Mendoza. It is called the Inca's bridge; and has its interior surface finely ornamented with large clusters of stalactites. Among these natural curiosities, we must notice an immense block of white marble completely insulated, and measuring in height 75 French feet, 224 in length, and 54 in breadth. It stands on the left bank of the river Maule, about four hundred paces from its mouth, and, from its appearance, has been called the church. It contains a vast arching cavity, furnished with three semicircular apertures. At one of these the sea enters, and the cavity is thus frequently visited by sea wolves.

Mineralogy. Chili contains almost every kind of metal. It has mines of gold, silver, copper, lead, iron, and tin. There has been lately discovered also in the mountains of Copiapo, the ore of a new metal unknown to the miners, but which, from their description, is supposed to be platina. **Metals.** *Gold* is particularly abundant, and found in all parts of the country; in every precipice and mountain, as well as in the sand of its numerous rivers. The principal gold mines are those of Copiapo, Guasco, Coquimbo, Petorca, Ligua, Tiltil, Putaendo, Caen, Alhue, Chibato, and Huilli-Patagua. The three last are of recent discovery, the others have been wrought since the conquest. The metal dug in the two provinces of Copiapo and Guasco, has, from its superior quality, received the appellation of *oro capote*. Though in Chili gold is found united with almost every sort of stone and earth, its usual matrix is a red clay stone, extremely brittle. The course of its veins is commonly from south to north. In some places, however, they descend almost vertically, and, in others, take a circular direction. Independent of the mines, great quantities of gold are obtained by washing the sands of rivers, which sometimes yield solid lumps of a pound in weight. This operation is generally performed by individuals of the poorer class, who are not able to afford the expence of mining. The gold of Chili is in general from 22 to 23½ carats. There has been no correct estimate of the quantity annually collected. That which pays the duty or fifth part to the king, amounts to about 900.000 pounds sterling; but there is also a very great proportion smuggled. This has been computed at more than a third part of the whole product. The ores of *silver* are confined to particular districts, and found only in the most elevated regions of the Andes. The most productive are those of St Jago, Coquimbo, Copiapo, and Aconcagua. In the last province is the mine of Aspalata, the largest and richest of the silver mines in Chili. Its precise extent is unknown, but it has been traced running in a northerly direction to the distance of thirty leagues, and is imagined by some to be a ramification of the mine of Potosi. It yields a sort of black ore, which is greatly esteemed. Of this ore there are three varieties, but the best of them is that called *piombo ronco*, which is the most readily separated. *Copper* is plentiful, and, like gold, is confined to no particular district. The best mines of it, however, are situated between the 24th and 36th degrees of latitude. The mine of Payen, which was formerly the most productive in Chili, has been long abandoned, on account of the hostility of the Puelches, in whose territories it was discovered. It is said to have produced pieces of pure metal, from fifty to a hundred pounds in weight, of a colour resembling pinchbeck, and containing, in most instances, more than an equal portion of gold. A mine, not inferior to this, has been lately opened at Curico. The copper of Chili is found variously mineralized; but, in general, it appears in combination, with a greater or less proportion of gold. There are only two kinds of it at present wrought by the inhabitants: these are the malleable copper, and the grey or bell-metal, which, from its composition, colour, and brittleness, may be regarded as a sort of native bronze. The others, though rich in metal, are considered as of no value, from the difficulty attending their separation. Of the malleable copper, those mines only are wrought, whose ore gives half its weight in refined metal; and there are at present open between the towns of Copiapo and Coquimbo more than a thousand such mines. Near the river Laxa in Huilquilemu, are hills which afford a beautiful native brass or copper in natural combination with zinc: it receives the name of Laxa copper. The mines of *tin* and *lead* are both equally neglected. Only so much of the lead is wrought, as may be required for the melting of silver and domestic purposes: small quantities of gold and silver are found in conjunction with it. Tin never appears in a continued vein, but is contained in a black stone of various form and dimensions. It is found also in coloured crystals. *Iron* also is very abundant, but the mining of it is prohibited in favour of the traders in that metal from Spain. Coquimbo and Copiapo abound in mines of it. **Semi-metals.** *Semimetals* of all kinds are found either separate, or mineralized with metallic ores. Antimony and quicksilver are the only two in any request; the first employed in refining the precious metals, the other being a royal monopoly. Virgin mercury is found in the province of Coquimbo, but it commonly appears in the form of Cinnabar. **Mines.** With respect to mines in general, the permission of government is to be obtained before working any newly discovered vein. An inspector is then appointed, who portions out the mine into three equal shares; one for the king, another for the proprietor of the land, and a third for the discoverer of the vein. If it prove rich, a village is quickly formed in the vicinity, by the immense number of persons that receive employment. An alcade or superintendant of the labourers is then appointed by the governor of the province. **Pyrites.** *Pyrites* are very numerous, but we shall notice only one species, which is the auriferous, found in Quillota, called the *Inca's stone.* It is cubical, and distinguished from all others by emitting but few sparks with the steel. **Bitumens.** The *bitumens*, are asphaltum, petroleum, pit-coal in great abundance, and several kinds of jet. Ambergris is often thrown out by the sea on the coast of Araucania and Chiloe. On the shores, also, are occasionally found pieces of yellow amber. Two small mountains of Copiapo consist almost entirely of a beautiful crystallized sulphur, so pure, that it does not want refining. *Salts* of these, are the blue, green, white, and mixed vitriol; sal ammoniac, with an excellent fossil salt, in the form of transparent cubes, crystallized and variously coloured. Several mountains of it occur in the Andes, west of Copiapo and Coquimbo; and it is used by all the inhabitants in the vicinity. A semi-crystallized aluminous stone, employed in the process of dyeing, and similar to that of Talca, is obtained from the Andes.

Stones. *Stones.* Of the siliceous kind, there are *rubies*, *sapphires*, *lapis lazuli*, and various sorts of *jasper*. At Coquimbo was found a beautiful *emerald*, and a very large *topaz* in the province of St Jago. *Amethysts* occur almost at every step in the crevices of rocks; and near Talca, there is a small hill consisting almost entirely of that stone. There are coloured *crystals* resembling most of the precious stones; and the Andes produce pieces of rock crystal, large enough to form columns six feet in height. These mountains abound also in *breccias*, *porphyries*, and *granite*. Among the calcarious sort, we may notice marbles of all colours, many of them finely striped and variegated. *Gypsum*, of which there are quarries in a semi-calcined state, slightly tinged with blue, and employed as a plaster for walls. There is a beautiful hexagonal *spar* found in the gold mines of Quillota, perfectly transparent, and striped with golden filaments. In the Andes are quarries of *alabaster*, with a sort of pellucid *selenite*, used for glass in the churches of St Jago. Of the *argillaceous*, the most remarkable are *asbestos* and the membranaceous *mica*, which supplies the place of glass, and being less fragile and more pliable, is by many preferred to that substance. **Concretions.** The *concretions* are *pumice-stone*, which forms the substance of several mountains; *turquoils* of a blue colour, which are found in the hills of Copiapo, and have generally been considered as a precious stone, but are nothing more than the teeth or bones of animals in a state of petrifaction; and petrified wood, which occurs in every part of the country. The Chilian willow is particularly susceptible of this change, and, in order to accomplish it, it is only necessary to place it for a short time under a moist and sandy soil. **Earths.** Chili contains *earths* of almost every description, the argillaceous, the calcareous, the sandy, and the mineral. Of the argillaceous, Molina has discovered five new species. Of these, the two most remarkable are the *argilla buccarina*, which is of a brown colour, spotted with yellow, pleasant to the smell, and even when manufactured into cups, &c. gives an agreeable flavour to the water drunk from them; and the *argilla rovia*, which supplies an excellent black, and is employed in dyeing wool. *Sand* abounds in the rivers of Chili; but is never found in such quantity on the plains as to prove injurious to vegetation.

Mineral waters. The most celebrated mineral springs of Chili are those of Peldehues and Cauquenes, both Spanish settlements. The Peldehues contains both a hot spring and a cold one. The hot spring is clear, inodorous, oily to the touch, and foams like soap, abounding in mineral alkali, and containing a small quantity of fixed air. Its specific gravity exceeds that of common distilled water only by two degrees. The cold spring is iron and vitriolic. The waters of both springs being distant from each other only about eighty feet, are united by means of canals, and form a tepid bath. This junction occasions a deposition of Glauber's salt, and of a yellowish ochre. The springs of the Cauquenes, situated near the source of the river Caciapol, in one of the vallies of the Andes, are extremely numerous both hot and cold, and possess very different qualities. Some are acidulated, and contain iron; others are alkalescent, or vitriolic; and others gaseous. There are a great many salt springs in the provinces of Copiapo and Coquimbo; and, in the former province, is the river Salado, which affords an excellent salt, so pure, that it may be used without any preparation.

VEGETABLE PRODUCTIONS. Chili is one of those countries where vegetable and mineral productions are found in equal abundance, and affords an exception to the general maxim, that mineral countries are deficient in vegetation. The plants of Chili are, on the contrary, every where profuse, vigorous and luxuriant.

Trees. Its plains, vallies, and mountains, abound with trees of unfading verdure and delightful fragrance. Of 97 species already discovered, only 13 shed their leaves. The *pellinos*, a species of oak, the pine, the cypress, and the red and white cedar, are found in a natural state in the valleys of the Andes. The *red cedar* is remarkable for its enormous dimensions, particularly in the Archipelago of Chiloe, where a single tree will sometimes yield 700 boards, each 20 feet long. In other parts of Chili are found the mulberry, the chirimoya, and the tamarind. Besides these we may notice particularly the *theige*, or Chilian willow, which yields manna, and whose bark is used by the natives as a preservative against fevers; the *molle*, of two kinds, the berries of which afford a red wine, well flavoured, but heating; the *Peruvian taper*, or cherry, whose thorns are eight inches in length, and serve as knitting needles; the wild orange, which supplies excellent wood of a fine yellow colour. The *floripondio*, remarkable for the beauty of its form, and the ambery fragrance of its flowers, which, by uniting its branches at the top, exhibits the appearance of a spherical crown; a single floripondio is sufficient to perfume a whole garden. The *canello* or Winter's bark, held sacred by the Araucanians, who carry branches of it on religious occasions, and, after concluding a peace, present them to the enemy as a token of reconciliation and friendship. The *carob tree*, remarkable for the extreme hardness of its thorns, which are sometimes employed instead of nails. The *maqui*, a species of cornel, from whose berries the Indians procure a sort of beverage called *theca*; in the juice of its leaves it affords a specific in cases of sore throat. The *luma*, or lofty myrtle, attains the height of 40 feet, and is exported to Peru for the use of coachmakers; the wine of its berries is reckoned a powerful stomachic. The *quillai* is a new genus, and named from the Chilian word *quilcan*, to wash; its bark, when reduced to powder, and sufficiently moistened, foams like soap, and supplies the domestic purposes of that substance. It is even more efficacious than soap in cleansing woollen cloths, but is apt to induce a yellowish tinge when applied to linens. The wood is so hard and tough as to be used in place of metal for stirrups. The *lithi*, or caustic laurel, gives out, in summer, an effluvia of a very peculiar quality, and operating only on certain constitutions. In some it occasions painful swellings or pustules, on the face and hands, either when stopping under its shade, or passing near it, while on others it has no sensible effect. Its leaves, which are oval and wrinkled, are of a dark green, and an inch in length; the fruit is similar to that of the common laurel; its wood is employed in houses and shipbuilding, and is valued for the extreme hardness which it acquires by remaining for some time under water. The *bollen* is found upon the sea coast, and, in point of appearance, is one of the finest trees in Chili; it is reckoned highly poisonous; the buds, however, when pulverized, are given by physicians as a powerful emetic, the dose not exceeding half a scruple; the *mayten* is a beautiful evergreen, of a new genus, found in the vicinity of the lithi; and affording an antidote to its poison; the *patagua*, whose trunk will sometimes measure eight yards in circumference, is much valued for a small flower in shape and smell resembling the lily. Chili, in its fruit trees, is greatly inferior to the tropical countries of America. The principal of them are the cocoa nut, the guevin, the pehuen, the peumo, and the lucuma. The fruit of the Chilian *cocoa nut* does not exceed in size a walnut; it grows in bunches containing sometimes a thousand individual nuts. The kernel is well tasted, and supplies an excellent oil. The *peheun*, or Araucanian pine, is by some supposed to be a new genus; its branches form a quadrangular pyramid; the leaves are three inches in length, heart-shaped, hard and shining; its fruit attains the size of a man's head, and in taste resembles the chesnut. The *peumo* is a new genus, having four species, and many varieties; the fruit of one of these (the *peumus mammosa*) yields kernels so hard as to serve for rosaries to the inhabitants; the bark is employed in tanning leather, and in dyeing. The fruit of the *lucuma*, which is also a new genus, in taste and size is somewhat similar to the peach. The various kinds of European fruit trees, vines, pulse, garden herbs, and flowers, are all found to succeed, and many of them to improve in Chili. Indeed, so favourable is its climate to vegetation, that at the same time, in the same orchard, fruit may be seen in all degrees of progress, in the bud, in the flower, green, and perfectly ripe. Pear and cherry trees produce twice a year. Extensive forests of apple trees are found in the province of Quillota, while oranges, lemons, and citrons, occur every where in the open fields. The grapes raised on the banks of the river Plata are most esteemed, and afford a sort of muscadel called Conception wine, which is equal to the best wines of Europe. The melons are excellent in their flavour, of an elongated form, with a very slender rhind. Among the numerous varieties, the musk melon and the *scritti* are the first in estimation.

Shrubs.

Among the shrubs, the most remarkable are the *thuraria*, of a new genus, and equal in its properties to that of Arabia; the *puga*, which supplies the inhabitants with cork, and which presents a very fantastical appearance, putting out from its root three or four trunks, in length about 20 inches, and as much in diameter; the *tuna*, a species of Indian fig, and equal to any of those in Europe; the *kali of Alicant*, in great abundance; and a certain climbing shrub which affords an alkaline salt for the use of soap boilers. Besides these are seven species of myrtle, of which the most valuable is the *agni*, or murtella, yielding a pleasant odoriferous liquor, which is reckoned superior to the best muscat. There are many shrubs likewise of a medicinal quality, which the native Chilese have understood and employed from time immemorial. Among these we may notice the *cullen* (*psoralea glandulosa*) indigenous to Chili, and well known as a powerful stomachic and vermifuge, the leaves of which, with those of the yellow cullen, a shrub of the same species, affords a balsam of amazing efficacy in the cure of wounds; a species of *acacia*, or mimosa, named *jarello*, which, from its branches, gives a vulnerary balsam. The root of the *guacuru* is also employed as a specific for all sorts of wounds, being of a quality powerfully astringent; it is used also with great success in cases of ulcer, scrophula, and dysentery. The expressed juice of the *palqui* is of excellent effect in inflammatory fevers; the wood is extremely brittle, and is employed by the Indians for producing fire. "This they accomplish," says Molina, "by friction, turning rapidly between their hands a small stick of this wood, in a hole made in another piece of the same kind."

Medicinal.

Herbs.

The herbage, particularly in the vallies of the Andes, is so tall and luxuriant, as entirely to conceal the sheep that pasture among it. There are three species of poisonous herbs which occasion madness in the animals that happen to browse them, especially in horses. The most injurious of these herbs is the *hippomanica*, which if a horse eat he will certainly die, unless immediately thrown into profuse perspiration. Of the alimentary herbs, the most valuable are the *gua*, or maize, which was the only species of corn cultivated in America before its discovery by Columbus, and still continues to be a very general crop in Chili; a species of bean called *degul*, and the *quinua*, a kind of chenopodium, which affords an agreeable stomachic beverage; the *magu*, a sort of rye, and the *tuca*, a species of barley, have been superseded in the estimation of the Araucanians, by the European wheat, which is now cultivated in their room. The potatoe is indigenous to America, and M. Bomare considers Chili as its native soil. There are two species of it, with about 30 varieties. The root of one of these (the *solanum cari*) is in shape cylindrical, and sweet to the taste. There are two species of the gourd, the white flowered gourd, and the yellow flowered; of the first are many varieties, some yielding a fruit that is sweet and nourishing, others a bitter fruit which is employed to ferment cider, and which, being of a large size and spherical, furnishes the inhabitants with their calabashes.

Alimentary.

The *quelghen*, or the strawberry of Chili, frequently attains the enormous size of a hen's egg, and differs farther from that of Europe in the roughness and succulency of its leaves; it is of three kinds, the red, the white, and the yellow; the two first are the most frequent; the yellow is found chiefly in the provinces of Puchacay and Huilquilemu. The seeds of the *madi*, a new genus, supply an oil which has been preferred to any of the French olive oils. Three species of the *pimento* are employed in seasoning. Besides these, and many other alimentary herbs, there is, in the province of St Jago, a particular species of wild *basil*, from whose leaves the inhabitants gather, every morning, a kind of salt, which in taste far exceeds the common salt.

Herbs used for dyeing.

Certain vegetable dyes have been long employed with success by the Chilians, producing lively and very durable colours, which yield neither in washing, nor by exposure to the air. The *relbun*, a species of madder, furnishes a beautiful red; yellow is obtained from a species of agrimony, and a kind of cress named *poquel*, the stalks of which supply also a green colour. The berries of the *cullen* give a violet; and the root of the *panke*, a perennial plant, yields a fine black, which, besides its use as a dye, possesses likewise the properties of an excellent ink.

Medicinal.

A knowledge of medicinal plants forms the whole medical science of the unconverted Chilians, who are careful to exclude all strangers from any participation in their accumulated experience. Without the advantages, however, of this desirable aid, there have been discovered nearly 200 medicinal herbs, the principal of which are the *cachanlahuen*, celebrated for its efficacy in fevers, sore throats, and pleurisy, and also as a purgative, dissolvent, and vermifuge; the *vira vira*, a kind of houseleek, extremely aromatic, and used in intermitting fevers, the infusion of which is sudorific, and given in catarrhal complaints; the *retamilla*, which possesses qualities similar to those of the vira vira; the *payco*, which is an excellent stomachic, and of much benefit in pleurisy; the *quinchamali*, whose juice is applied to bruises; the *pichoa*, the *clinclin*, and the *guilno*, all of them purgatives; the *diuca-lahuen*, vulnerary; and the *corecore*, a specific for the toothache. Chili affords two kinds of cultivated tobacco, the common, and the little tobacco, of which the last is by far the most powerful.

Climbing plants and grasses.

Of *climbing plants*, the most remarkable is the *cogul*, which having reached the top of one tree, immediately begins to descend, and in a short time has attained the summit of another, from which it proceeds in the same manner to a third; it has thus frequently been found to extend itself over a space of 200 yards. The stalk being tough, and extremely pliable, is used for baskets and cables, and these cables are said to be more durable even than those of hemp. The *pepoi* is used for similar purposes, in the Archipelago of Chiloe, and supplies excellent ropes for the Periaguas. We shall notice only two species of grass, the *quila*, whose stalk the Araucanians use for their lances; and the rush of Valdivia, which affords a handsome cane, is employed in the manufacture of cages, and serves the inhabitants as a covering for their houses.

Mallows, endive, trefoil, and some others, are common to Chili and Europe; lupins, love apples, celery, mustard, Spanish pimento, and cresses, occur in a wild state. Of tropical plants, are the pine-apple, the sugar cane, the banana, the cotton, jalap, mechoacan, and the sweet potatoe, all of which succeed in the northern provinces.

ANIMAL PRODUCTIONS.

Though Chili is not inferior to any part of the New World, in soil, climate, and vegetation, it must yield to the other countries of America in the number of its animal productions.

Quadrupeds.

The horse, the ass, horned cattle, sheep, goats, dogs, and cats, were early introduced by the Spaniards, and most of them, besides increasing in size, have greatly improved in their peculiar qualities. The *horses* are well shaped, swift, vigorous, and spirited. They are divided into three breeds, each named from its invariable and distinguishing gait. The *trotters* are the strongest, and much used by the country people; the *pacers*, remarkable for an easy, active, and well-supported motion, are principally used in long journies, in great demand, and preferred to the best horses of Andalusia; the *parade horses*, which never quit a foot pace, are only used on occasion of show and ceremony. These last are highly valued, and cost, about thirty years ago, from one hundred to five hundred crowns; while the price of a common horse did not exceed four shillings sterling. The mountain horses are harder and more robust than those of the plain, and their hoofs are so firm as only to require shoes when employed in cities. The peasants of Chili are almost perpetually on horseback, and not unfrequently perform journies of a hundred leagues upon the same animal, permitting him only to feed and rest during the night. The *ass*, more than any other European quadruped, has undergone a favourable and almost unaccountable alteration; but, though greatly surpassing the original stock in strength and size, is very seldom put to any use. It is found wild on the Andes, and hunted for the sake of its skin. The *mules* are strong, sure-footed, and active. The *horned cattle* have enjoyed a more than proportional share of the general improvement, and display different degrees of excellence, according to the richness of their pasture. The *oxen* of the midland provinces are of a larger size than those of the maritime, and are excelled, in their turn, by such as are reared in the vallies of the Andes; they are yoked to the plough in pairs, and drag it by means of a rope passed through their horns. It is a common practice among the land holders to fatten a thousand head of cattle, either cows or oxen, and to slaughter them at Christmas. Very little of this beef, however, is consumed in the country, but is chiefly disposed of in Peru. The *sheep* breed twice a year, and are equal to any in Spain. The breed has been crossed by the Pehuelches, and the result is an animal considerably larger than a sheep; its hair, which is often two feet in length, and somewhat curled, possesses all the softness of wool. The other quadrupeds we shall notice are indigenous to Chili. The *guemel* or *huemel*, in size, hair, and colour, bears a considerable resemblance to the ass, but differs from that animal in the formation of its ears, which are short and pointed; in shape also it is more handsome. The voice is a sort of neigh, and its teeth are exactly similar to those of a horse. It is fleet and headstrong, and found only in the most inaccessible regions of the Andes. The vicugna, chilihueque, and guanaco, in their manners and economy, are not unlike the camel; and, though greatly inferior in point of size, they somewhat resemble it also, in the structure of their internal parts: except the guanaco, however, neither of these animals have an arched back, and all of them, in the upper jaw, are completely destitute both of incisors and canine teeth. Their only defence, when attacked, or otherwise molested, is to squirt from their mouths a quantity of saliva, which is said to be of a caustic nature. The *vicugna* is about the size of a tame goat, but greatly exceeding it, in the length of its neck and legs. It inhabits the coldest and most precipitous ridges of the Andes, and has never been domesticated. Vicugnas are of a mild and timid disposition, and taken in great numbers for the sake of their wool. Being first compelled by the hunters into a narrow circuit, they are immediately surrounded by a rope, to which are attached, at short intervals, a great number of rags: and not daring to encounter this formidable barrier, they are, without difficulty, overpowered and put to death. The wool, which is of a pale rose colour and very fine, bears a high value in Europe. In the stomach is found the bezoar stone. The flesh, which affords an excellent nourishment, is sometimes applied externally in cases of ophthalmia. The *chilihueque*, or, as the name implies, the sheep of Chili, was originally called *hueque*, but the epithet *chili* was afterwards prefixed, in order to distinguish it from the Spanish sheep. It was anciently employed as a beast of burthen, and guided by a string passed through the rim of one of its ears. It has of late, however, entirely given place to the *mule*, which, for services of that nature, is now universally preferred. It is four feet high, and about six in length. The wool, which is long and soft, and not confined to any particular colour, is superior to the Spanish, and reserved entirely for the more costly articles. The *guanaco*, or *lua*, approaches the horse in size, and equals him in speed. It is hunted with dogs, but the old ones are seldom taken except by the Indians, who, being well mounted, and furnished with a *laqui*,[*] can strike and entangle them at the distance of three hundred paces. The guanaco is readily domesticated, and becomes often so extremely familiar as to follow its master like a dog. Its hair is employed in the manufacture of hats, and the flesh is prepared and put up for the use of seamen. Besides these, we may notice the *viscacha*, which, in its appearance, unites the fox and rabbit; the tail and colour being those of a fox, and the form of the other parts, as likewise its manners, connecting it with the rabbit; whose hair supplied the ancient Chilians with a very beautiful cloth, but is now manufactured into hats. The great *wood mouse*, which resembles the marmot in colour, while it doubles it in size, and is completely distinguished from that animal by its characteristic features; with several other kinds of mice, varying considerably in colour, habits, and dimensions. The *covur* or armadilla, of which there are four species. The largest of these is the *bola*, or eighteen banded, in length 13 inches; the *pichi*, or four banded, which is the least, measures only 6 inches. Of *carnivorous* animals, the most formidable is the *pagi*, or, as the Peruvians name it, the *puma*. Considered as a species, it seems to form a link between the lion and the tiger, though, in size and courage, it is greatly inferior to either. It is about five feet long, of a greyish ash colour dashed with yellow spots. Its head is round, like that of the cat, and like the cat also it is fawning and treacherous in its disposition. It is particularly destructive to horses, and upon discovering two of these animals fastened together in the fields, has been known to make sure of both, by first killing one, and while dragging it off, by striking the other with its paw and compelling it to follow and share the fate of its companion. Notwithstanding, however, its strength and dexterity, the *pagi* has learnt to dread the aspect of man, and a woman or child is often sufficient to scare it from its prey. It is hunted with dogs, and, while engaged in defence, a noose is secretly slipped over its head by one of the hunters. When thus entangled, it is said to "roar terribly and to shed a torrent of tears." The skin is manufactured into a strong leather, and afterwards converted into boots and shoes. There is a species of ferret called *chinghue*, which, when attacked, besprinkles its assailant with a sort of greenish oil, from a vesicle situated similarly with that of the polecat, of an odour so intolerably offensive as effectually to preclude any farther molestation. Assured of safety from this singular resource, it fears neither dogs nor men, and will boldly enter the houses in search of plunder, nothing daring to thwart its passage, or call forth its displeasure. There is but one method of destruction which the inhabitants venture to practise against the intruder. While some one engages its notice by caresses, another catches it up by the tail, and the muscles being from this position so much contracted, as to prevent the emission of its loathsome fluid, the animal is dispatched without apprehension. The odour reaches to a great distance, and repeated washings are necessary in order to purify garments that have once received its pollution. The skin is much valued by the Indians, who use it for bed-covers. There are likewise the *porcupine*, the *culpeu* or *wild dog*, *wild cats*, and *weasels*. In the rivers are found the *coypu*, a kind of water rat, equal in size to the otter, and capable of domestication; and the *guillino*, a species of beaver, in high estimation for the excellence of its fur. The sea contains a great number of *phocæ*, besides the *chinchimen*, which, with a strong external resemblance, possesses all the ferocious cruelty of a wild cat, and will dart upon any one that approaches it.

Birds.

A great number of birds occur in Chili which are common throughout Europe; such as kites, falcons, herons, gulls, swans, geese, ducks, plovers, crows, pigeons, partridges, and domestic fowls. Some of these are found in many varieties, but we shall notice only two: the *royal duck*, which is distinguished by its superior size, a large red comb which adorns its head, and a ring of white feathers about its neck; and the *red-headed heron*, whose plumage is of a pure white, except the beautiful crest, which affords its descriptive appellation. Partridges are said to be so extremely numerous, that the muleteers of St Jago, without almost needing to step aside from the road, knock them down in great numbers with their cudgels, and carry them for sale to Valparaiso. Of carnivorous birds, are the *jota* of the vulture tribe; the *tharu*, a kind of eagle, which instead of pursuing seizes its prey by stratagem; the *pequen*, a small owl, remarkable for the extensive burrows which it forms under ground, where it also deposits and hatches its eggs: But the principal of this tribe is the *condor*, in Chili called manque, which, from its enormous strength and rapacity, proves often extremely injurious in its depredations. Besides preying on sheep and goats, several of them will seize upon a calf, scoop out its eyes with their beaks, and instantly tear it in pieces. This bird is taken by a very simple contrivance. A peasant extended upon his back covers himself with the fresh hide of an ox, while others conceal themselves at a short distance; and when the condor, in expectation of a repast, alights upon the skin, its legs are immediately seized and held fast, till the assistants rushing forward, overpower it with their clubs. The

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[*] "The *laqui* is a strip of leather, five or six feet long, to each end of which is fastened a stone about two pounds weight. The huntsman, who is on horseback, holds one of these stones in his hand, and whirls the other round like a sling, as swiftly as possible, in order to hurl it with more force, when he throws it at the animal he has singled out, which he is almost certain of striking."—MOLINA.

American *ostrich* differs from that of Africa, in having three toes in place of two, and in being entirely destitute of any horny substance upon its wings, and of callosities on the sternum. It is inferior also in size, but fully its equal in voracity, and will swallow iron if presented. *Parrots*, particularly the species named *jaguilma*, are remarkably numerous, and frequently lay waste the fields to a great extent: Fortunately they do not arrive from the Andes till after harvest, and in compensation, their flesh affords a delicious food to the inhabitants. Among birds of song, the *thenca* stands incomparably the first, both for the sweetness and variety of its music. In allusion to the last property, it has been called, in Mexico, the *centzontlatotle*, or the four hundred tongues. Its song gives the idea of a great number of birds uniting their voices in the most perfect harmony. The sprightly and active disposition of this bird cannot be reconciled to captivity, where it pines and dies. The *careu* is another of the thrush kind, which, besides its great powers of music and imitation, is remarkable for the singular propensity which it sometimes exhibits of destroying smaller birds, in order to feast upon their brains. There are three species of the humming bird, all of the most dazzling splendour, and some of them extremely diminutive: the smallest weighs only two grains. Among the aquatic birds, we may notice a species of *pelican*, whose sack, from its transparency, is employed for lanterns. The *flamingo*, which, from the length and formation of its legs, is unable, after the manner of other birds, to cover its eggs by stooping; but when hatching them has the ludicrous appearance of sitting upon a chair, the nest for its accommodation being raised in a conical form. The *pillu*, a kind of ibis, which is about the size of a goose, and remarkable for the length of its legs, which measure upwards of two feet and a half; and the *penguin*, of which there are several varieties.

Fish. Though it has been observed, in general, that the animal productions of Chili are less numerous than those of other countries in America, the remark does not hold in the case of fishes, which are found every where along the coast, and in the rivers in immense variety and profusion. Exclusive of the fresh water kinds, the fishermen are acquainted with 76 species of esculent fish, most of which are peculiar and entirely unknown in the northern ocean. Those most in request are the *robalo* and the *corvino*, both white in their flesh, and of a delicious flavour. The *lisa*, which in form and taste resembles the mullet, and the *king's fish*, so named from the excellence of its flavour. The *tollo* is remarkable for two spines of a triangular shape, very hard and crooked at the point; which are mentioned as a powerful remedy for the tooth-ach; the effect is simply produced by the application of one of these points to the diseased tooth. The following are common to other seas, the skate, the ray, the torpedo, the cod, the sole, the whiting, the turbot, the tunny and the mackerel; the barbet, the mullet, the anchovy, the electrical eel, and the sword-fish. At the islands of Juan Fernandez the cod is as plentiful and as readily taken as on the banks of Newfoundland. It has lately also been fished with success on the coast of Valparaiso, where it arrives in large shoals, during the months of November and December. The fresh waters of Chili supply fish in less variety, but in still greater numbers than the ocean. Of these, the finest are the *trout*, the *cauqui*, the *malche*, the *yuli*, the *cumarca*, the *lisa*, which is of the same species with the salt water fish of that name already noticed, but of a superior quality; and the *bagre*, whose flesh is yellow, and of all others the most esteemed as a [illegible]. Chili affords a great number of *crabs* and *crawfish*, remarkable for their size and goodness; *oysters*, *muscles*, *cocles*, *barnacles*, and several species of *molluscas*. There is also a kind of cuttle fish, individuals of which have been caught of a hundred and fifty pounds weight. Eels are confined to the provinces of Araucania, where they are taken in great abundance. In the river Talton is found a small fish called *paye*, which is represented by the natives as so extremely transparent, that any object placed under several of these animals piled the one above the other, would still remain perfectly visible. "If this property," says Molina, "is not greatly exaggerated, the paye might serve to discover the secret progress of digestion, and the motion of the fluids." *Whales*, equal in size to those of the northern ocean, make their appearance in great numbers in quest of fish, at the mouths of the Chilian rivers. Molina was himself witness to the dimensions of one of these animals, which had been cast ashore on the coast of the Chones, and which measured 96 feet in length.

Reptiles. Chili contains but few reptiles; these are the salt and fresh water turtles, lizards, frogs, toads, and a species of serpent, not exceeding three feet in length, which is perfectly harmless. Various incredible relations have been propagated of an immense water serpent, which is said to prey upon men and the larger animals, but have received little countenance from the more respectable authorities.

Insects. Of the insect tribe, we may notice a kind of *chrysomela*, which is of a bright golden colour, and when strung together like beads, is used by the inhabitants for necklaces and other ornaments; *caterpillars*, one of which, found between the rivers Rapel and Metaquito, produces a silk not inferior to that of Europe; a species of *water-fly*, which, from its agreeable musky odour, the inhabitants make use of to perfume their clothes. There are likewise bees, ants, scorpions, glow-worms, a single species of grashopper, and a few beetles. Chili is neither infested with gnats, wasps, nor musquitoes. Molina describes a *spider*, which he says is the only one known in the country, grows to the size of a hen's egg, and is quite inoffensive. Byron, however, mentions in his Narrative, a large venomous spider, whose bite will prove mortal, if proper remedies are not speedily applied. He was himself bit by one of them on the face, while at St Jago, and his whole cheek, in consequence, became perfectly black. The poison was extracted, he tells us, by the application of a bluish coloured stone, which sticks of itself to the wound, and drops off when saturated.

Manufactures. Though Chili supplies great abundance of raw materials, such as wool, skins, metals, flax, and hemp, the manufacturing industry has hitherto been extremely limited. The principal articles of manufactures are woollen stuffs, converted into cloaks, quilts, ponchos, carpets, stockings, and blankets; cordovan and sole leather, soap, skin-coats, saddles, and hats.

Commerce. External. The external commerce of Chili is carried on with Peru, Spain, and Buenos Ayres. About twenty years ago, twenty-three vessels were employed in the trade with Peru, each of 600 tons. They made three voyages annually, and exported wheat, wine, almonds, nuts, pears, apples, conserves, pulse, dried meat, neat-tongues, and cheese; besides, leather, tallow, cordage, copper, and timber for building. The imports, in return, were silver, iron, cloth, linen made at Quito, cotton, sugar, rice, cacao, sweet-meats, pickles, tobacco, oil, earthen ware, and all sorts of European commodities. The yearly exports amounted in value to 700,000 dollars. The imported articles were estimated at 500,000, leaving in favour of Chili a balance of 200,000 dollars. To

Buenos Ayres, Chili sends linen and woollen stuffs, partly imported from Peru, and partly of home manufacture; ponchos, sugar, snuff, wine, and brandy; and receives in exchange, wax, the herb paraguay, and negroes. The exports to Spain are gold, which amounted, at the abovementioned period, to 656,000 dollars; silver to the value of 244,000 dollars;[*] a few hides, and a small quantity of Vicugna wool; and in return, European goods were imported to the amount of a million of dollars: in both cases a considerable balance remained against Chili. The remittances of silver to Spain are conveyed, every summer, in two vessels, which also carry a part of the gold.

Internal.

The articles of home traffic are ponchos, carpets, stockings, blankets, skin coats, saddles, hats, and some others, intended principally for the use of the lower ranks, the higher class being in general supplied from the manufactures of Europe. Valparaiso receives provisions to the value of ten thousand dollars, and supplies the rest of the country with cedar. Chiloe sends to Valparaiso and Conception several kinds of valuable wood, woollen stuffs in the shape of ponchos, quilts, &c. besides dried pilchards and hams, in high estimation for their peculiar delicacy of flavour. The trade with the Araucanians consists in supplying them with edge-tools, toys, and wine; for which the Spaniards receive horses, horned cattle, and sometimes even children. The manner of conducting the exchange is thus described by Ulloa:

Traffic with the Indians.

"The Spaniard begins his negotiation by offering the chief of the family a cup of wine; after this he displays his wares, that the Indian may make choice of what best pleases him, mentioning at the same time the return he expects. If they agree, the Spaniard makes him a present of a little wine; and the Indian chief informs the community, that they are at liberty to trade with that Spaniard as his friend. Relying on this protection, the Spaniard goes from hut to hut, recommending himself, at first, by giving the head of every family a taste of his wine. After this they enter upon business, and the Indian having taken what he wanted, the trader goes away without receiving any equivalent at that time, and visits the other huts, as they lie dispersed all over the country, till he has disposed of his stock. He then returns to the cottage of the chief, calling on his customers in his way, and acquainting them that he is on his return home. Upon this summons, not one fails of bringing him to the chief's hut whatever had been agreed upon. Here they take their leave of him, with all the appearance of a sincere friendship; and the chief even orders some Indians to escort him to the frontiers, and assist him in driving the cattle he has received in exchange for his goods." A sort of fair is held annually on the Spanish frontiers by the Pehuenches, who, besides horses, cattle, skins, wool, gypsum, pitch, fossil salt, feathers, and ostrich eggs, expose also for barter many neat articles of their own manufacture, such as ponchos, bed covers, bridle reins finely wrought of plaited leather, baskets, wooden vessels, &c. for which they expect in return, wheat, wine, and some European commodities.

Government.

Civil and military.

The administration of the Spanish provinces is committed to an officer, residing one half of the year at St Jago, and the other at Conception, who is invested with the combined authority of president, governor, and captain general of Chili. During war, he is subordinate in some particulars to the viceroy of Peru, but is otherwise dependent only on the king. In his military capacity, he is at the head of the army, having under him the four governors of Chiloe, Valdivia, Valparaiso, and Juan Fernandez, the quarter-master, the sergeant major, and the commissary. In quality of president and governor, his jurisdiction is supreme in matters of a civil nature; he superintends and presides over the superior tribunals of St Jago, whose authority extends over the rest of the kingdom. Of these, the principal is the Royal Audience, celebrated for its justice and impartiality. It is divided into a civil and criminal court, the decisions of both of which are without appeal. Every province, besides a subdelegate who acts both in a civil and military capacity, has, or at least is directed to have, a municipal magistracy, called the Cabildo, established in the chief city of the province.

Military establishments.

The regular forces maintained in Chili by the king of Spain originally amounted to 2000 men, which number was afterwards reduced to 500, but has since that time been considerably augmented, to what particular extent we are not informed. There is, besides, a regular city and country militia. The number enrolled in 1792 amounted to 16,000 picked men, who were not required to perform the inferior duties of sentinels and patroles, but to exercise continually in arms, and to hold themselves in readiness for any sudden emergency.

Revenue.

The produce of the revenue offices was, in 1746, insufficient to defray the expences of the regular force, which did not then exceed 500 men. Since that period, however, the revenues have greatly increased: but we are not in possession of such data as might enable us to compute the amount.

Religious establishments.

The religion of Spanish Chili, like that of the mother country, is the Roman Catholic. Among the numerous orders of the Romish church, only five have succeeded in obtaining permanent establishments. The monks of the order of Mercy accompanied Valdivia from Peru. The Dominicans and strict Franciscans were shortly after introduced, under the same authority. The Augustines procured admission in 1595; and the Brothers of St John of God in 1615. The three first orders form separate jurisdictions. The Jesuits had established themselves in 1593, but upon the dissolution of the order, they were expelled from the territories of Spain. The Chilians are extremely averse to the admission of new fraternities, and have always resisted their establishment. The two bishoprics of St Jago and Conception comprehend, under their jurisdiction, the whole of Chili, besides the province of Cujo. To the diocese of St Jago belong Cujo, and all the provinces between Peru and the river Maule. The diocese of Conception comprehends, with the islands, the rest of Chili; the inhabitants, however, of this jurisdiction are chiefly pagans. At St Jago there is a commissioner of inquisition, with several inferior officers, delegated by the court of inquisition at Lima.

State of literature, fine arts, &c.

From the scarcity of scientific books and instruments, as well as the enormous expence of printing, literature and the fine arts were, about the year 1792, in a very low stage of improvement. Law is a favourite study, and many young men, after completing their academical course in Chili, proceed to Peru to be instructed in that science at the schools of Lima. The peasants compose a sort of rude verses, which though wanting in elegance and polish, are yet interesting from their extreme simplicity. They have also among them a sort of improvisatori, called *Palladores*, whose extemporaneous effusions obtain for them a high character, and form their only occupation. The mechanical arts, excepting those of carpentry and the working of metals, have made but little progress. A favourable impulse, however, has of late years been given to the arts and sciences in general, by a liberal patronage on the part of government, of which the good effects have already appeared.

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[*] Humboldt estimates the value of the gold and silver furnished by the mines of Chili, from the period of the conquest up to the year 1803, at 29,571,021 pounds sterling.

Population. The population of Chili consists principally of Spaniards, Indians, and Mustees, besides whom are a few French, English, and Italians, and some Negroes. There exists no proper estimate of the general amount, nor any sufficient data by which to compute it; but it is certain, that the country is yet very far from being stocked with inhabitants. The encouragement given to commerce has proved particularly favourable to the Spanish population; that of the Indian provinces, however, has been considerably retarded by the immoderate use of spirituous liquors.

First inhabitants. The Spanish provinces were anciently possessed by the Copiapins, Coquimbanes, Quillotanes, Mapochinians, Promaucians, Cures, Cauques, and Pencons; most of which, once flourishing tribes, are now almost completely extinct, and the only remains of them are a few hamlets, the principal of which is *Laro* in the province of Maulé. These tribes, before the arrival of the Spaniards, had evidently attained some degree of civilization. They had established themselves in villages, each of which had an *Ulmen* or chief magistrate. They seem to have made considerable progress in agriculture: convenient and well-constructed aqueducts were employed in some districts to irrigate the fields; and there still remains a canal in the vicinity of St Jago, which, in its extent and workmanship, may be regarded as a standing monument of their industry and skill. They were acquainted also with the process of fermentation, and from their grain and berries obtained several kinds of liquors. In the manufacture of cloths, they used the spindle, the distaff, and two sorts of looms. They employed a variety of nets, the cord of which was procured from the plant *gnochia*. Hatchets of bell-metal-copper sometimes occur in the ancient sepulchres. They employed dyes, both vegetable and mineral, and of all colours; and fixed them by means of the stone called *polcura*. Their language was rich and harmonious, and contained terms to express the numbers ten, a hundred, and a thousand. But of all their attainments, the knowledge they displayed in astronomy and physic is by far the most remarkable. Of these, and of their religion, music, and military skill, a detailed account will be found in the article ARAUCANIA. To this article we must refer also for a description of their manners and customs; the Araucanians, as Molina observes, being still the faithful depositories of all the science and ancient customs of the Chilians.

Pehuenches. The tribes of native Chilians that still maintain their possessions and independence are the Araucanians comprehending the Puelches, to an account of whom we have just referred; the Pehuenches, Chiquillanes, Cunches, and Huilliches, allies of the Araucanians, but in some respects differing from that people in their manners and customs. The Pehuenches occupy that part of the southern Andes lying between the 34th and 37th degrees of latitude. They dwell in tents made of skins; and, for the convenience of pasturage, are continually changing their situation. They are expert riders, and spend the day on horseback: the bits which they use, as also the stirrups and spurs, are of wood. They frequently employ themselves in hunting the guanaco and ostrich, and use the *laqui* both in this exercise and in war. In dress they differ from the Araucanians, by covering the waist with a piece of loose cloth in place of drawers; and delighting in ornament, they paint their bodies, faces, and particularly their eye lids. Though possessing numerous herds of sheep and horned cattle, they live in general upon the flesh of horses. Of the other tribes, there is little mentioned deserving particular notice. Molina observes in general, of the mountaineers who inhabit the eastern vallies of the Andes, (including under that designation the Puelches, Pehuenches, Huilliches, and Chiquillanes,) that their complexions are much redder than those of their countrymen, who dwell to the westward of that mountain; "that they all dress themselves in skins, paint their faces, live in general by hunting, and lead a wandering and unsettled life;" that they are, "generally speaking, of a lofty stature and great strength, and no other than the celebrated Patagonians, who have occasionally extended their wanderings to the Straits of Magellan, and have at one time been described as giants, and at another as men little above the common stature."

The colour of the Indians, in general, is a copper brown; but the inhabitants of Boroa, a tribe in the heart of Araucania, are white, and in their features and complexion little inferior to the northern Europeans. M. Rollin, who accompanied La Perouse as surgeon major, describes the Indians whom he saw at Conception, as of lower stature than Europeans, their faces as larger and more rounded, the features more strongly marked, the eyes small, black, and deep seated, the forehead low, the eye-brows black and shaggy, the nose short and flatted, the cheek bones high, the lip thick, the mouth wide, and the chin diminutive. Very few of the native Chilians have almost any beard, being accustomed to pluck it out with pincers.

Language. They all speak the same language; a language remarkable for its regularity, softness, and power of expression. The Chilian is in no respect connected with the other American languages, and differs essentially from them all, both in its words and construction. The rules of its composition are simple and precise, and the theory of the language may be acquired with the greatest facility. There is not in its whole vocabulary one irregular verb or noun. It contains a great number of radical words; but the genius of the language consists in the formation of compounds, which are extremely numerous. Except the *x*, which is wanting, the Chilian alphabet is the same with that of the Latin. Like the Latin, also, its harmony is somewhat injured by a too frequent recurrence of the letter *u*. It does not, however, possess a single guttural letter or vocal aspirate.

Spanish inhabitants, manners, and customs. The population of Spanish Chili, as we have before noticed, has been considerably augmented since the removal of certain impolitic and oppressive restrictions upon maritime commerce. The wealthier inhabitants are in general fond of splendour and magnificence, which appears in their dress and equipage. The fashions are directed by those of Lima. Byron, who resided for some time in the country, gives the following description of the manners and customs of St Jago. "In their assemblies many intrigues are carried on, for they think of nothing else throughout the year. Their fandangoes are very agreeable. The women dance inimitably, most of them have delightful voices, and all play upon the guitar and harp: on the harp they excel every other nation. They are extremely polite; and when asked either to play, dance, or sing, they do it without a moment's hesitation, and that with an exceeding good grace. They have many figure dances; but what they take most delight in are more like our hornpipes than any thing I can compare them to, and upon these occasions they shew surprising agility. The women are remarkably handsome, and very extravagant in their dress. Their hair, which is as thick as can be conceived, they wear of a vast length, without any other ornament upon the head than a few flowers. They plait it behind in four plaits, and twist it round a bodkin, at each end of which is a diamond rose. In winter they have an upper waistcoat of cloth of gold or silver, and, in summer, of the finest linen covered with the finest Flanders lace. When they go abroad, they wear a veil, which is so contrived that one eye only is seen. Their feet are very small, and they value themselves as much upon it as the Chinese do.[*] Their breasts and shoulders are very naked, and indeed you may easily discover the whole shape from their manner of dress. They have fine sparkling eyes, ready wit, a great deal of good nature, and a strong disposition to gallantry. Paragua tea, which they call *matte*, is always drunk twice a day. They drink it through the conveyance of a long silver tube, at the end of which is a round strainer to prevent the herb getting through. And here it is reckoned a piece of politeness in the lady, to suck the tube two or three times first, and then give it to the stranger without wiping it. They eat every thing so highly seasoned with red pepper, that those who are not used to it, upon the first mouthful would imagine their throats on fire for an hour afterwards. The ladies sit cross-legged, after the Moorish fashion, upon the estrado, which is a platform raised about five or six inches above the floor, and covered with carpets and velvet cushions. The common vehicle is a calash or vis-a-vis, drawn by one mule only. Bull feasts are a common diversion here, and surpass any thing of that kind I ever saw at Lisbon or any where else."

Peasantry. The peasants are a healthy and robust race of men, chiefly consisting of Creoles. They are bold and dextrous horsemen, fond of riding, and almost ever on the saddle. They are amazingly expert, also, in the use of the *laqui*,[†] which is their principal weapon, employing it on all occasions, both in hunting and in their private quarrels. The Spanish Creoles possess all the estimable and engaging qualities which characterize those of English and French descent. They are brave, active, and enterprising, frank in their manners, and of the strictest honour. Their prejudices are few and easily eradicated. Their temper is generous and unsuspecting, but at the same time ardent and impetuous in the pursuit of pleasure, and too frequently transports them beyond the strict bounds of moderation. They are fond of learning, and possess a degree of penetration, sagacity, and correctness of thought, that might ensure success in almost any study.

The Spanish inhabitants, in general, are of a hospitable and generous disposition. As but few inns have been established in the country, their houses are at all times open to strangers and travellers, whom they entertain with a degree of kindness and liberality unequalled almost among any other people.

We may here notice a garment of very general use, both among Indians and Spaniards, which, though differing in quality and ornament, according to the rank of the wearer, retains always its peculiar and distinguishing form. It is called *poncho*, and consists of a piece of quilted cloth about three yards in length and two in breadth, having an opening in the middle just large enough to admit the head. It hangs down on all sides, serving completely the purposes of a cloak, while it leaves the motion of the arms more free and unembarrased.

Negroes. The negroes are wholly employed in domestic services, and treated with a degree of tenderness and humanity that greatly alleviates their state of servitude. They are protected from any extreme cruelty on the part of their masters, should these be so inclined, by a law permitting the slave, in a case of this nature, to demand, and obliging the master to grant, *a letter of sale*, by which the former is authorised to seek a purchaser. There exists also another regulation in their favour, which has the force of law among the inhabitants, that, when any one has, by his industry or good conduct, acquired a sum of money, sufficient to purchase a substitute, his master is bound to receive it, and set him at liberty. Negroes born in the country, and mulattos, are preferred to such as have been imported, as more readily attaching themselves to the families of their owners.

Diseases. No contagious disorder was ever experienced in Chili, till the arrival of the Spaniards, when the small-pox was first introduced, and raged, in some provinces, with the fatality of a pestilence. Since that period the Indians have contrived to save themselves from its ravages. When any one is suspected of having, from intercourse with the Spaniards, caught the infection, they immediately set fire to his hut by means of flaming arrows, and thus, by the violent sacrifice of an individual, arrest the progress of a distemper, which, if at first neglected, might eventually depopulate their provinces. Inoculation was introduced in 1761, by Matthias Verdugo, a monk of the order of St John. Chili is entirely exempted from many diseases peculiar to warm climates, such as the leprosy, the siam fever, and the black vomit. The rickets, hydrophobia, tertian and quartan agues, are unknown in the country. The most formidable disease to which the inhabitants are subject is a violent fever, sometimes prevalent among the peasantry, termed *chacao longo*, or the disorder of the head, from its being accompanied with delirium. The Indians cure it by certain herbs.

See Molina's *Natural and Civil History of Chili;* Byron's *Narrative;* Ulloa's *Voyages; English Universal History;* Perouse's *Voyage round the World;* Humboldt's *Political Account of New Spain;* and Kerr's *Voyages and Travels.* (U)

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[*] La Perouse describes their shoes as so extremely short that the toes are bent double, which makes their feet appear almost round.

[†] This laqui differs from that used by the Indians, in having a single noose, in place of a ball at each end.—Ulloa informs us, that the Spanish peasantry can strike and halter the object of their attack, with almost unerring certainty, at the distance of 30 or 40 paces, but that a small distance, such as ten or fifteen paces, renders their dexterity in some measure ineffectual. He relates an instance of their address, with regard to an Englishman whom he knew at Conception. "This man was in the long-boat of a privateer, then lying in Conception Bay, intending to land at Talcaguana with a view of plundering the neighbouring villages, when a body of the country militia made to the shore in order to oppose them. Upon this the English fired upon them with their musketry; and no sooner had they discharged their pieces, than one of the peasants, though the boat was at a considerable distance, threw his noose, and, notwithstanding all in the boat threw themselves on their faces, he noosed the above-mentioned person, pulling him out of the boat with the greatest rapidity, while the others, instead of endeavouring to save him, thought of nothing in their fright but how to get out of danger as soon as possible."

CHILODIA, a new genus of plants of the class Didynamia, and order Gymnospermia. See BOTANY, p. 255; and Brown's *Prodr. Plant. Nov. Holl.* &c. p. 507.

CHILOE, or ANCUND, *the Archipelago of*, is situated in a large bay at the southern extremity of Chili. The original settlers, having emigrated from Chili, as is manifest from their manners and language, gave it the name of *Chil-hue*, (hence Chiloe), i. e. a district of Chili. It is bounded on the north and east by the continent, on the west by the Pacific Ocean, and on the south by the Archipelago of Guaytecas. As a province of Chili, it comprehends a small portion of the continent, extending to the district of Osorno on the north, and to the Cordilleras on the east. Its discovery, in 1558, by Don Garcia de Mendoza; the unresisted subjugation of its inhabitants in 1566, then amounting to 70,000, by a troop of sixty Spaniards under Ruiz Gamboa; and their feeble endeavour, at the commencement of the last century, to recover their independence;—these transactions are briefly noticed in the history of Chili, and we shall not here repeat them. The number of islands in the Archipelago, comprehending the Chones which are dependent upon it, does not exceed 82, of which 32 are inhabited. The island of Chiloe, or Isla Grand, is by much the largest in the Archipelago. It lies at the mouth of the bay, and extends in a direction north and south from the 41st and a half to the 44th degree of latitude, forming two straits or passages with the continent: the passage at the northern extremity is about a league in breadth; the other is upwards of twelve leagues. In this, as in the other islands, the land is considerably elevated, and rises into mountains, overspread with impenetrable thickets: It contains forty-one settlements. The other islands are of very insignificant dimensions, except a few that measure in length from twelve to fifteen leagues. Six settlements have been established on the Isle of Quinchau; Laicha and Lemui contain each of them four; Calbuco has three, and the rest only one each. These settlements cannot properly be denominated towns, as in most of them the houses lie dispersed, and at a considerable distance from each other.

Towns.

The only towns in the Archipelago, are the city of Castro, Chacao, San Carlos, and Calbuco. *Castro*, founded in 1566, by Ruiz Gamboa, is the capital of the province, and stands on an arm of the sea, in south latitude 42° 58′, west longitude 303° 15′. *Chacao*, acknowledging the same founder, was, previous to the erection of San Carlos, the principal sea-port, and the residence of the governor: it is situated in 42° of south latitude, and 307° 37′ west longitude. The harbour affords good anchorage, though somewhat exposed to the north and north-east winds; but the entrance, from the rapidity of the currents, and certain hidden rocks in the middle channel, is rendered extremely hazardous. *San Carlos* is now the principal port, and the seat of government; and though founded so late as the year 1768, is superior to all the other towns, both in prosperity and extent. In 1791, it contained 200 houses, occupied by more than 1100 inhabitants. It lies in south latitude 41° 57′. Though the harbour itself is good, frequent wrecks are occasioned at its entrance, by the sudden and overwhelming hurricanes which afflict these islands. *Calbuco* belongs to the island of that name, which is the station of a commandant, and lies at the north end of the bay.

Climate.

The climate of the Archipelago is temperate, and seldom incommoded by the extremes of heat or cold. It is sufficiently marked, however, by its excessive humidity: the rain falls in torrents, and continues often, without any intermission, to deluge the islands for the space of a month. Except in the autumnal season, eight days of fair weather is a very rare and unexpected occurrence. During that season, however, the Chilotes commonly enjoy a respite of several weeks. These rains are seldom accompanied by thunder or lightning, but they are attended with frequent hurricanes, which sometimes prove extremely injurious. Owing to the rocky and mountainous character of these islands, cultivation is almost wholly confined to the plain grounds near the coast; the interior contains a few cultivated vallies. The degree of tillage given to this small portion, if we may judge from the extreme rudeness of the agricultural implements, must be very imperfect. Two crooked stakes, sharpened at the point, are made to serve the purpose of a plough, and both are worked by a single labourer. He seizes a stake in each hand, and applying the heads to his breast, forces their points into the ground, and turns up the soil by extreme exertion: the labour is considerably augmented by the vast number of myrtle roots which every where abound throughout the cultivated lands. The seed, previous to this scratching, has been scattered over the ground, which has also received a sufficient quantity of manure from the flocks of sheep which, for that purpose, are always made to pasture upon it, for three months before cultivation.

Cultivation and vegetables.

The excessive moisture of the climate, though no way injurious to its salubrity, is extremely unfavourable to the interests of agriculture. On account of the weather, it is always necessary, in order to save the crop, to cut it down before it is perfectly ripe, often when it is yet green, and to dry it in sheds and barns. Wheat, notwithstanding these disadvantages, gives a tolerable crop, yielding, at an average, twelve for one. Maize and barley succeed well; several kinds of pulse are cultivted with success; but the principal crop is potatoes, which are large, and of the very best quality. Bread is considered as a luxury, especially wheat bread, and is confined almost exclusively to the houses of the more wealthy inhabitants. An excellent substitute is afforded by the *luche*, a marine plant, which being sufficiently dried, is afterwards, by some unexplained method of preparation, converted into loaves. From their barley, reduced to meal, the Chilotes obtain a pleasant sort of ale, called *chica*, which will intoxicate if taken in considerable quantity. Of fruits, the number is very small, and none of them reach maturity except apples and strawberries, which grow wild, and in great abundance. The woods supply the *alerce*, or red cedar, a large and beautiful tree, of which a single stem will afford from six to eight hundred boards, each twenty feet long. Its wood is of a very singular quality, and, from its peculiar evenness of grain, can be divided as exactly, with the assistance of a few wedges, and formed into boards as smooth and level as if the finest saw had been used in the operation. The bark is employed as oakum, and serves the purpose well for those parts of a ship that remain under water, but it will not stand exposure to the sun or atmosphere. We may notice also the hazle, the cypress, the *luma*, a species of myrtle, and the ciruelillo, all of them used as articles of commerce.

Animals.

Of domestic animals, the most numerous are sheep and hogs. The wool of the sheep gives employment to the female Indians, who manufacture it into ponches. The hams of Chiloe are reckoned the finest in South America. All attempts to introduce the ass have proved ineffectual; those transported having constantly perished a short time after their introduction. The horse and the ox have succeeded better, and their number is now considerable. The principal wild animals are otters, deers, and foxes, of which the last are black, equal in size to the European fox, and corresponding with the blue fox of Chili. Fowls also are numerous, both wild and domestic. One of the most useful is the *quethu*, a species of penguin about the size of a common duck: its body is furnished with a soft ash-coloured plumage, the texture of which approaches so near to wool or fine hair, that it is spun by the natives, and woven into beautiful bed covers. It is about the size of a domestic goose, never appears in flocks, but remains always in pairs. The sea, as if to compensate for the natural deficiences of soil and climate, supplies, in the most profuse abundance, almost every sort of fish. A very summary method is employed to obtain them. A large extent, at the mouths of rivers and other favourable situations, is enclosed with palisades, the vacuities between which are occupied with a sort of basket work; an opening is left towards the sea, and this is carefully secured before the tide begins to ebb. By this simple contrivance, such quantities of fish are sometimes taken, that numbers will remain untouched in the enclosure, after all the inhabitants in the neighbourhood, and others from a considerable distance, have supplied their wants. *Whales* of a great size have been cast ashore on the opposite continent. Among the numerous *Phocæ* that inhabit these seas, the *lume*, or sea elephant, which occurs in the Archipelago, is by much the largest. Individuals have been taken of this species measuring in length 22 feet, and 15 feet in circumference.

Manufactures and commerce.

The Chilotes possess few materials for manufacture; their principal articles are ponchos, bed coverings, blankets, rugs, carpets, embroidered girdles, and linen cloth. Much industry and neatness of workmanship are employed in weaving a poncho: this manufacture is performed by the women, without the assistance of a loom, the warp being extended and made fast by means of pegs: the operation, however, is altogether so tedious, that two ponchos are commonly the whole production of a woman's labour during a year. Besides, the above article of manufacture, the Chilotes export hams, pilchards, dried shellfish, and ambergris; white cedar boxes, cedar boards, the wood of the luma for poles of coaches and axle-trees, and hazle for ship-building; these they barter for sugar, wine, brandy, tobacco, salt, herb of Paraguay, and some European commodities. This small commerce was carried on in 1792 by four vessels from Chili and Peru, which paid an annual visit to the Archipelago. When any of these vessels arrive at San Carlos, the natives assemble from all quarters to dispose of their surplus goods; and, in order to prevent imposition, the exchange is regulated by the Cabildo or municipality of the town, who set a value upon the articles for barter.

Government, religion, &c.

The affairs of the province are placed under the administration of a Spanish governor, who resides at San Carlos, and is immediately dependent on the captain-general of Chili. A commandant is stationed in the island of Calbuco; and in the city of Castro, there is a magistrate or cabildo, whose office it is to determine the private suits of the Indians. The Indians are divided into seventy-six ulmenates, some of which are subject to the Ulmens of the district; but most of them are under the immediate cognizance of Spanish officers. Though the feudal practice of requiring personal service be no longer enforced in the other provinces of Chili, fifty days service is still rigidly exacted throughout the Archipelago. San Carlos is furnished with a garrison of fifty-three dragoons, fifty-three infantry, and thirty-three artillerymen. The militia of the province amounts in all to 1569 men, who must perform garrison duty without pay. In its religious concerns, the Archipelago belongs to the diocese of Conception, and contains three parishes. There are two convents, one of Franciscans, the other of Mercedarii, which are the residence of a few monks. The Jesuits had a parish church and a college.

Population.

The population consists of two distinct classes, Spaniards and Indians. It is a curious fact, that these separate races have at no time intermingled, as in the other provinces. According to the latest accounts from the Archipelago, the total amount of the inhabitants was computed at 26,000, of which 15,000 were Spaniards. At the period of their submission to the Spaniards (1566), the Indian inhabitants amounted to 70,000. In the year 1792, they did not exceed 11,000. Are we to ascribe this otherwise unaccountable reduction to the murderous tyranny of the Spaniards? The submissive Chilotes afforded little pretence for open violence; and if violent means were not employed, how cruelly laborious and oppressive must be that servitude, which could so exhaust a flourishing population. In their appearance, dress, and cutsoms, the Chilotes differ little from the continental Chilians. Their language was originally the same as the Araucanian or Moluche, but of late years a remarkable change has taken place in this respect: they have gradually adopted the Spanish vocables in room of the Chilese; while of the latter, they have minutely retained not only the syntax and idioms, but even the inflections and accent. Byron describes these people as of a robust but not inelegant make, extremely well featured, and remarkably neat in their dress. The poncho is in general use among them. They wear a sort of buskin on their legs, which, however, does not not extend to the feet; these always remaining uncovered, as in such a climate shoes would only serve to retain the moisture, without the possibility of preventing its admission. The Chilotes possess a remarkable quickness of apprehension, and learn readily whatever is made the object of their study. They display a strong mechanical genius, and have attained considerable excellence in carpentry, cabinet-making, and turnery. The disposition most prevalent among them is that of gentleness and timidity; yet the Chilotes yield to no other people in the firmness with which they encounter the perils of a tempestuous ocean. They are fearless and active sailors; and it deserves remark, that a people possessed apparently of so much physical and moral energy, accustomed daily to brave the most imminent hazards, and to endure the severest fatigues, should, with such inglorious facility, have submitted their lives, their possessions, and their freedom, to the tyrannical disposal of a few strangers. The Chilotes readily embraced the doctrines of Christianity, and they continue to observe its duties with an exemplary strictness. The Spaniards born in the Archipelago are in general of a robust and healthy constitution. The Spanish women are well-complexioned, and tolerably handsome, but they disfigure their faces, in a ludicrous manner, by their mode of painting.

The houses in the Archipelago, whether of Spaniards or Indians, are mere hovels. They are entirely built of wood, and consist commonly of a single apartment, in the centre of which is placed the fire; and as there is no regular chimney, the roof is furnished with two small openings, one at each end, which serve as vent holes for the smoke (U)

CHILOGLOTTIS, a new genus of plants of the class Gynandria, and order Monandria. See BOTANY, p. 317, and Brown's *Prodromus, Plant. Nov. Holl.* &c. p. 322.

CHIMARRHIS, a genus of plants of the class Pentandria, and order Monogynia. See BOTANY, p. 146.

CHINA.

Topography.
Extent.

CHINA PROPER, an immense country in Asia, extends about 18 degrees from north to south, and nearly an equal distance from east to west. It is bounded on the east by the sea; on the west by lofty mountains and extensive desarts; on the south by the ocean, and the kingdoms of Tunkin, Laos, and Cochinchina; and on the north by the regions of Tartary, from which it is divided by a stupendous wall 1500 miles in length.

Name.

By the Chinese, their country is called *Tchong-Koué*, or the middle kingdom, because they formerly imagined, that it was situated in the centre of the earth, and that all other countries lay scattered around their empire in the form of small islands. In later times they have, indeed, acquired a more correct geography; but so inveterately do they adhere to ancient opinions, and especially to whatever flatters their national vanity, that they still continue to express themselves in this erroneous manner, and to preserve unaltered every sentiment and expression of their great philosopher Confucius. By the western Tartars, it is called *Catay*; by the Mantchew Tartars, *Nicancourou;* by the Japanese, *Thau;* and by the natives of Siam and Cochinchina, *Cin*. It is supposed, that the word China is derived either from this last appellation, or from *Tsin*, or *Tai-tsin*, the name of the first imperial family, who carried their arms towards the west.

Division.

China is divided into fifteen provinces; Pe-tchelee, Shansee and Shensee, situated towards the north and north west; Setchuen and Yunnan, on the west; Quansée and Quanton, on the south; Fokien, Tchekian, Kiannan, and Shantong, on the east; and Honan, Houquang, Koetchou, and Kiangsée, in the middle region. Of these provinces a very laborious and accurate survey was made by order of the Chinese government, under the direction of the Jesuit missionaries, in which they are said to have employed a period of ten years, and of which a beautiful manuscript map, by a Chinese, is deposited in his majesty's library at Buckingham house.

Pe-tchelee.

I. PE-TCHELEE, *Tchelee*, or *Li-pa-foo*, is the principal province of the empire; and its capital, Pekin, is the ordinary residence of the court. This city is situated in a fruitful plain, about 20 leagues distant from the great wall of Tartary. Its name signifies *the northern court*, which distinguishes it from Nankin, *the southern court*, where the emperor formerly resided; but found it necessary to remove nearer to the northern boundaries of the empire, to repel more effectually the frequent incursions of his Tartar neighbours in that quarter.

Pekin.

The city of Pekin forms an oblong square, inclosing an area of 12 miles, exclusive of the suburbs, and is divided into two towns, the one inhabited by Tartars, and the other by Chinese. This division, or rather addition, took place at the Tartar conquest, when the new sovereign crowded the capital with such numbers of his own nation, that the Chinese were under the necessity of building a new city without the walls of the old one. The walls of Pekin, especially of the Tartar city, are of considerable height and breadth, and are formed of two lines of brick or stone, the middle space being filled up by the earth, which is dug out of the surrounding ditch. They are generally 30 feet high, 25 feet thick at the base, and 12 feet across the top within the parapets. There are nine lofty and arched gates, (whence Pekin is sometimes called "the city with nine gates,") of which three are placed in the south wall, and two in each of the other sides. Over each gate is a large pavilion-roofed tower, divided into nine stories, with port-holes, or apertures, in the wall; and, before each of the gates, is a large open space, inclosed by a semicircular wall, equal in height and thickness to that which surrounds the city. At each angle of the city wall, also, is a similar large square building, rising above the parapet to the height of four stories; and, in each of the sides, there are, on each floor, fourteen windows or port-holes. These structures are now used only as public granaries, or rice magazines. Along the whole course of the wall, at the distance of a bow-shot, or 70 yards from each other, are spacious towers, projecting about 40 feet from the line of the wall, with a small guard-house on the summit of each.

Topography

Emperor's palace.

The middle gate of the south side opens into the emperor's palace, which is situated in the centre of the Tartar city. This imperial residence comprehends a vast assemblage of immense buildings, extensive courts, and magnificent gardens. It occupies a space about a mile in length, and three quarters of a mile in breadth, and is inclosed on all sides by double walls of red polished bricks, 20 feet high. Through the middle of this inclosure winds a considerable rivulet, formed into canals, basons, and lakes, and adorned with artificial rocks, mounts, and grottos. This palace is peculiarly distinguished by the singular structure of its pavilion roofs, which are covered with varnished tiles of so brilliant a yellow, as to have the appearance, at a distance, of being gilded.

Between the other two gates on the south side, and the corresponding opposite gates in the north wall, run two parallel and straight streets, each about four English miles in length, and 120 feet in breadth. Of the two streets which stretch, in like manner, from the two eastern to the opposite western gates, one is equally wide and straight as the other main streets; but the other is interrupted by the north wall of the palace, round which therefore it is carried in its progress. The cross streets are only lanes branching from these principal streets in right angles, exceedingly narrow, but filled with houses of the same appearance as the larger streets. The main streets are lined on every side with shops and warehouses, before which the goods are brought out and displayed in various groups. In front of these shops, are generally erected large wooden pillars, higher than the eves of the houses, with inscriptions upon them in gilt letters, describing the nature of the wares within, and the reputation of the dealer; and, in order to attract the notice of passengers, they are hung with various coloured flags and ribbands from top to bottom, so as to have the appearance of a line of shipping dressed. The sides of the houses also are painted with different colours, chiefly sky-blue or green, mixed with gold. The streets are not paved, but covered with sand and dust, on account of which the cross lanes are frequently watered.

At the points, where the great streets intersect each other, are erected monuments or triumphal arches, in memory of those, who have attained remarkable longevity, or distinguished themselves in the service of the state. These structures consist of a large central gateway, with a smaller one on each side, covered with narrow roofs;

Topography. are built sometimes of wood, but generally of brick; and are varnished and painted, like the houses, in a very splendid style. There are abundance of wells throughout the city; but, the water is extremely bad. Within the northern wall, also, is a large sheet of water, several acres in extent, and a small stream running along the western wall, which supply the neighbouring districts. There are no common sewers to carry off the dirt and dregs of the city; but, from the scarcity and value of manure in China, no kind of filth or offensive substance is ever thrown out into the streets. Every family collects its own refuse into a large earthen jar, the contents of which are sold for money, or exchanged for vegetables from the gardeners. In consequence, however, of the preservation of these various kinds of excrement in the houses, and the multitude of little carts employed in conveying it to the neighbouring fields, the air of the city is filled throughout with a very disgusting odour.

Population. No correct idea can be formed of the population of Pekin, or of any Chinese city, from the extent of the inclosing walls; as they have, in general, within their compass large patches of unoccupied land, which often exceed the space of ground upon which the buildings stand. In that part of the capital called the Chinese city, several hundred acres are in cultivation; in the imperial residence, more than two-thirds of the whole are occupied by parks or pleasure grounds; and under the north wall of the Tartar town, as has been already mentioned, is a large pond or swamp about 50 acres in extent. These spaces of open ground are supposed to have been reserved, as appears also to have been done in several of the celebrated ancient cities of Asia, for the purpose of yielding a supply of onions, garlic, and other pungent vegetables, during the time of a siege.

Appearance. The external appearance of Pekin does not excite very high expectations in the mind of the traveller; as none of the buildings can be seen over-topping the wall, and not even a chimney rises above the roofs of the houses. Neither has the inside view much variety of aspect, as every street is laid out in the same manner, and every house built upon the same plan. The streets and lanes are disposed in straight lines, and the houses all of the same height, seldom exceeding one story; and, except the great shops, none of them have any windows towards the street in front; so that the whole has more the appearance of a large encampment, than of an ancient city. But the bustle and number of its moving objects, present a sufficient variety and succession of scenery to the view. The cross streets or lanes are said to be extremely quiet, and free of crowds; but the great streets, which lie in the direction of the gates, and which are the only outlets to the city, are constantly thronged with people. The following striking description by an intelligent eye-witness, will give the best idea of the busy scene. "The multitude of moveable workshops of tinkers and barbers, coblers and blacksmiths; the tents and booths, where tea and fruit, rice and other vegetables were exposed for sale, with the wares and merchandise arrayed before the doors, had contracted this spacious street to a narrow road in the middle, just wide enough for two of our little vehicles to pass each other. The cavalcade of officers and soldiers, that preceded the embassy; the processions of men in office attended by their numerous retinues, bearing umbrellas and flags, painted lanterns and a variety of large insignia of their rank and station; different trains, that were accompanying, with lamentable cries, corpses to their graves, and, with squalling music, brides to their husbands; the troops of dromedaries laden with coals from Tartary; the wheel-barrows, and hand carts, stuffed with vegetables, occupied nearly the whole of this middle space in one continued line, leaving very little room for the cavalcade of the embassy to pass. All was in motion. The sides of the streets were filled with an immense concourse of people, buying and selling and bartering their different commodities. The buz and confused noises of this mixed multitude, proceeding from the loud bawling of those, who were crying their wares, the wrangling of others, and every now and then a strange twanging noise, like the jarring of a cracked Jew's-harp, (the barber's signal made by his tweezers,) the mirth and laughter, which prevailed in every groupe, could scarcely be exceeded by the brokers in the Bank Rotunda, or by the Jews and old women in Rosemary-lane. Pedlars with their packs, and jugglers, and conjurers, and fortune-tellers, mountebanks and quack-doctors, comedians and musicians, left no space unoccupied." "The show of the embassy," adds the author, "was but an accessary. Every one pursued his business at the same time that he gratified his curiosity." [*]

The cities of China are divided into three classes, *Foo*, *Tcheoo*, and *Hien*; each of which comprehends a certain number of square leagues under its jurisdiction. Besides Pekin, the capital of the whole empire, the province of Pe-tche-lee contains 9 cities of the first class, 40 of the second, and 108 of the third. Those of the first order are Pao-ting-foo, which is the most considerable city in the province next to Pekin, and where the viceroy has his residence. It is situated in a pleasant and fruitful district; and is remarkable chiefly for a large lake in the middle of it, which abounds with the celebrated Chinese water lily, *lien-wha*. Hokien-foo, situated between two rivers, and noted for the cleanliness of its streets. Tching-ting-foo, situated on the banks of a beautiful river, is a well walled town, about four miles in circumference, and is celebrated for the medicinal plants, which are found upon the mountains in its neighbourhood. Shun-te-foo, is placed in the midst of a fertile and populous country, full of lakes and rivers, which abound in excellent craw fish; and its territory produces the best touch-stone in China, and also a fine kind of sand, which is used for polishing precious stones, and which is sold in every part of the empire. Quan-ping-foo, in the south of the province, is surrounded by a well-watered country. Tai-ming-foo, of which nothing worth mentioning is recorded. Yung-ping-foo, situated near the sea and encompassed by rivers, yields from its surrounding mountains abundance of tin. Suen-wha-foo, an extensive, populous, and well built city, situated near the great wall, and surrounded by fortresses. Its mountainous district yields very fine crystals and marbles, and a species of large yellow rat, the skins of which are much valued by the Chinese.

The province of Pe-tche-lee, extends from 38° to 40½° north latitude, and enjoys a fine clear atmosphere throughout the year. The temperature is various, generally about 80°, and occasionally 90° of Fahrenheit's thermometer during the day; but in the middle of winter, it frequently descends to the freezing point, and sometimes even to zero. According to the observations of Mr Barrow, the range of the thermometer in the month of August was found to be from 80° to 88° in the middle of the day, and during the night, generally, from 60° to 64°. In September, the medium temperature was about 76°. In October, about 68°, and at night as low as 44°. Its winter season is described as remarkably cold in proportion to its latitude; and the rivers are said to be so much frozen during four months of the year, that horses and waggons can pass upon the ice. The ice dissolves very slowly; the air, at the same time, is not so pinching to the feelings during these severe frosts as in Europe; and provisions of every kind may be kept for a long time without being subject to putrefaction. These circumstances have been ascribed to the quantity of nitre in the province, and to the serenity of the sky, which, even in winter, is seldom obscured by a cloud. There are very few mountains in the province; and the general face of the country is extremely level. At high water, it is not much more than two feet above the surface of the rivers; and the tide, which rises only nine or ten feet in the gulf of Pe-tche-lee, flows 110 miles into the bosom of the country, up the river Pei-ho, which frequently submerges the whole district through which it passes. Along the banks of this river a light sandy soil chiefly prevails, with a mixture of argillaceous earth, and slimy matter, interspersed with shining particles of mica; but not a stone of any magnitude, nor pebble, nor even gravel, is to be seen in the whole course of the river, as far as it is navigable. On the southern coast of the gulf of Pe-tche-lee, there are several hills all of the same size, and form regular cones with smooth sides, entirely detached from one another, and each standing upon its own base, so as to have all the appearance of having been artificially formed. The water in this province, especially near Pekin, when taken from the springs or rivers, leaves a kind of tartar of a yellowish colour in the vessels, in which it has been boiled, or has stood for some time. The plague never makes its appearance in this province, and the people are remarkably free from epidemic distempers. It has been remarked, that the inhabitants of this part of the empire have not the same aptitude in acquiring the sciences, as those of the more southern provinces; but they are much more warlike, hardy, and robust.

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[*] Barrow's *Travels in China.*

Shan see.

II. SHAN-SEE, *Shang see*, *Chan-see*, or *Xan-see*, is one of the smallest provinces of the empire, but is considered as the spot where the first inhabitants of China, or at least the first founders of the nation, had their residence. It contains five cities of the first class, 16 of the second, and 70 of the third. Tai-yuen-foo, the capital of the province, is an ancient city, about three leagues in circumference, formerly the residence of the imperial family, but now much decayed in its splendour. The palaces of its royal inhabitants are reduced to ruins; and their tombs, on a neighbouring mountain, are the only memorials of their existence. These monuments are all of marble or cut stone, spread over a considerable space; mingled with triumphal arches, statues of heroes, figures of horses, lions, and other animals; and the whole surrounded by groves of cypress trees, planted in chequer. The territory around this city is fruitful and pleasant; and its principal articles of trade are hardware, stuffs of different kinds, but particularly carpets in imitation of those of Turkey. Pin-hiang-foo, nearly equal to the capital in the fertility of its soil, and the extent of its district. Lou-ngan-foo, pleasantly situated at the source of a river. Fuen-tcheoo-foo, an ancient and commercial city on the banks of the river Fuen-ho, famed for its hot-baths and springs, which attract numbers of strangers, and add greatly to its opulence. Tai-tong-foo, built near to the great wall, and well garrisoned, is a place of great strength, and has an extensive jurisdiction. Its vicinity abounds in medicinal herbs, lapis lazuli, marble, porphyry, and a beautiful kind of jasper. The climate of this province is pleasant and healthful; and the atmosphere generally pure throughout the year. The thermometer of Fahrenheit is often, for many days in winter, below the freezing point, and sometimes descends to zero. The soil is very fertile, and the vines produce the best grapes in China. It is full of mountains; some of which are entirely uninhabited, and have a very frightful appearance. But the greater part of them are carefully cultivated, and cut into terraces from top to bottom. On the summits of some of them are found extensive plains, which are said to be as fruitful as the richest low lands. They abound in jasper, lapis lazuli, marble, porphyry, iron ore, crystal, salt pits, and inexhaustible coal mines. The inhabitants are strong-limbed; and the women accounted handsome.

Shensee.

III. SHEN-SEE, *Chen-see*, or *Xen-see*, is divided into two parts, Eastern and Western, and is one of the most extensive provinces of the empire. It contains 8 cities of the first class, 22 of the second, and 84 of the third; of which the capital, Sin-gan-foo, is said to be inferior only to Pekin in beauty and extent. Its walls are strong and lofty, four miles in circumference, flanked with numerous towers, and surrounded by a deep ditch. It contains a palace, in which the sovereigns of China once resided; but the rest of its buildings are not much superior to those of other cities in the country. The principal Tartar troops, destined for the defence of the northern parts of the empire, are stationed in this city, in a separate quarter, inclosed by a wall of its own. In the neighbourhood of the city, is found a singular species of bats, as large, it is said, as domestic fowls, and the flesh of which is preferred by the Chinese to that of chicken. It was near this city, that the famous marble table, mentioned by Father Le Compte, was dug up, in the year 1645, which was considered as a monument of the Christian religion, and which was understood as demonstrating the existence of Christianity in China, as early as the period between 636 to 782. Han-tchong-foo, a large and populous city on the river Han, and remarkable for the high road in its vicinity, which is carried over very lofty mountains and deep vallies. Ping-leang-foo, a considerable city in the western part of the province, on the river Kin-ho, is surrounded with picturesque mountains, and numerous streams of water. In its vicinity is a valley so deep as to be almost impervious to the rays of the sun, and through the middle of which passes a high-way, paved with large square stones. Kong-tchan-foo, surrounded by inaccessible mountains, on one of which is to be seen an old sepulchral monument, which the Chinese consider as the tomb of Fo-hee or Fo-shee.* Lan-tcheoo, though only of the second order of cities, is one of the most important in the province, is the capital of the western portion, and the seat of the viceroy. It is situated near the great wall, and not very distant from the principal ports of the western coast. Its territories are watered by the great Yellow-river; and its trade consists in skins brought from Tartary, different kinds of woollen manufacture, and a coarse stuff made of cow's hair, used for great-coats as a protection from snow.

This province is celebrated for its wealth and commerce. Its soil is in general extremely fertile, and produces abundance of wheat and millet, but little rice. It is subject to excessive droughts, and destructive visits from locusts. It abounds in drugs, cinnabar, wax, honey, and inexhaustible veins of coal. It contains also gold mines, which the government does not permit to be opened; but gold-dust is washed down by the rivers in so great abundance, that numbers of the inhabitants gain their subsistence by collecting it. One of the most remarkable objects in the province, is the high-way cut across the mountains, and leading towards the capital; a work which was done at immense labour by the military during an expedition, and in the course of which are to be seen lofty bridges thrown over vallies, so high that it is fearful to look down, but at the same time so wide that four horsemen can ride along, abreast. The inhabitants of this province are said to excel the other Chinese in stature and strength, and likewise in genius and affability to strangers.

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* The *h* in the Chinese language has always a sibilant sound before the vowel sound of *i*, *ee*, or *y*.

Se tchuen.

IV. Se-tchuen, *Se-thuen*, or *Sou-chou*, contains ten cities of the first class, 16 of the second, and 72 of the third, besides a number of forts and strong-holds. Tchingtoo-foo, its capital, was formerly an imperial residence, and one of the finest cities of China; but it was almost entirely destroyed in 1646, during the civil wars which preceded the last Tartar invasion. It still contains many magnificent ruins of palaces, bridges, and temples; and as it is situated in a plain, surrounded by canals and navigable rivers, it carries on a very considerable trade. Tchong-king-foo is one of the most trading towns in the province, in consequence of its favourable situation at the confluence of two large rivers, the Hin-tcha-kiang and the Ta-kiang. It is built upon a mountain, in the form of an amphitheatre; and the surrounding air is healthful and temperate. It is celebrated for the excellent fish caught in its vicinity, and for the manufacture of a peculiar kind of trunk made of canes, interwoven in the manner of basket-work. Tong-tchuen-foo is a fortified place, of which all the inhabitants are soldiers, and whose forefathers have followed the same profession for many generations.

This province is rich in mines of tin, iron, and lead; produces loadstone and lapis lazuli; abounds in silk, and is famous for its breed of horses. Its amber, sugar-cane, musk, and rhubarb, are highly esteemed; and it has numerous salt-pits in the mountains, from which the inhabitants draw all the salt which they use.

Yun-nan.

V. Yun-nan, *Jun-nan*, or *Yu nan*, contains 21 cities of the first class, 25 of the second, and 30 of the third. Yun-nan-foo, its capital, is celebrated for its magnificent edifices, triumphal arches, squares, gardens, and sepulchral monuments; but the Tartars, in their various incursions, have reduced the greater part of them to ruins. Its trade consists chiefly in metal; and its principal manufacture is a particular kind of satin, made of twisted silk, without flower or gloss. The other cities are not deserving of particular notice; but the province is one of the most opulent and fertile in China. Its commerce is very extensive, and consists chiefly in its own productions, gold, copper, tin, amber, and precious stones, marble, silk, linen, gums, musk, and medicinal herbs, elephants, and horses. Its inhabitants are brave, active, and robust, addicted to the cultivation of the sciences, and skilled both in agriculture and arms.

Quan-see.

VI. Quan-see, *Quoang-see*, or *Koan-see*, contains 12 cities of the first order, 25 of the second, and 73 of the third. Quei-ling-foo, situated on the banks of a narrow and rapid river, is a large city, built in the form of an ancient fortress; and is chiefly noted for the variety of birds in its district, whose plumage is so brilliant, that their feathers are frequently interwoven with silk stuffs to add to their lustre. The most remarkable of these birds is called *King kee*, or golden fowl, and is described in another part of this article. The other cities contain nothing remarkable. This province is inferior to most of the rest in wealth and extent; but it is peculiarly fertile in the growth of rice, with which it supplies the neighbouring provinces; and it contains mines of copper, tin, silver, and gold. It is celebrated for containing a singular species of tree, which, instead of pith, has a very soft pulp, from which a farinaceous substance is prepared, and converted into bread. It abounds also in a variety of curious birds, and uncommon insects, one of which produces great quantities of wax. Its wild animals are numerous, among which are found the rhinoceros, and the porcupine. The inhabitants of the western and northern districts are savage and independent mountaineers; but in the east they are more civilized, and much engaged in traffic of different kinds.

Quang-ton.

VII. Quang-ton, *Koang-ton*, or *Canton*, contains 10 cities of the first class, and a multitude of the other inferior orders. Quang-tcheoo, Quang-ton, or Canton

Canton.

the capital of the province, is situated upon a beautiful river, which communicates by means of canals with all the neighbouring provinces; and is full of merchants from all quarters of the empire, whose warehouses contain the most valuable productions of China. It is divided into three distinct cities, which, when all united, form together a regular square. The streets are long and straight, paved chiefly with cut stones, adorned at intervals with triumphal arches, and continually crowded, especially with porters, transporting the goods from place to place. They are in general very narrow; and the porcelain street, which is only from 15 to 20 feet broad, is considered as one of the largest in the city. Some of them are completely covered above, and in these the richest shops are to be found. The houses are remarkable for their neatness, consisting only of one story, and have no windows towards the street. The shops of the more wealthy merchants consist of a number of apartments in a line, opening into each other. The first, or outward apartment, is generally filled with coarse porcelain, toys, and such articles as the common Chinese are daily purchasing, and is entirely open towards the street, that passengers may easily observe what it contains. In the middle of this apartment is an opening or passage to the second, which is stored with finer porcelain, such as is purchased by European traders. Next to this, is a third vault or warehouse, filled with silks, velvets, and similar commodities. And perhaps a fourth is to be seen, in which tea, and other articles of a like nature, are arranged. On great festival days, these long narrow houses are thrown open, illuminated, ornamented with artificial flowers and trees, and provided with musicians, who occupy the most remote apartment. The river is bordered on each side with fields of rice, which appear like extensive meadows, and which are intersected by numerous canals. These are covered with boats; and upon the river, particularly, a kind of floating city may be seen, composed of barks of all descriptions, arranged in rows like streets, touching each other; and inhabited by families, who employ themselves in fishing in the waters, or in cultivating rice upon the banks. Four leagues from Canton, is the famous village of Fo-han, which is considered as the largest and most populous in the world. It is about a league in circumference, contains about a million of inhabitants, and carries on an extensive trade; but is called a village, because it is not surrounded with walls, or honoured with a particular governor. Its size and population, however, appear to be greatly exaggerated. It is described by a recent traveller, as, indeed, about a league in circumference, and as containing large well built houses; but there is only one line of buildings along the side of the river, with a very few cross streets in one or two places, which extend so short a space, that those who sail upon the river, can perceive through these openings fields behind the village. In this province, at the entrance of the bay of Canton, is the Portuguese port, called Macao, which they are said to have obtained from the Chinese, as a reward for the assistance which they afforded, in destroying a noted pirate who infested the coast. But they pay, nevertheless, a tribute of 100,000 ducats, for the liberty of choosing their own magistrates, and of living according to their own customs. There are, besides, a multitude of Chinese in the place, who are under the inspection of a mandarin; a circumstance which sometimes occasions a clashing of authorities, and renders the situation of the Portuguese governor extremely embarrassing. The town is situated upon a peninsula or rather small island, almost entirely separated from the continent by a river, and connected with it only by a small neck of land, which is inclosed by a wall. It is built in the form of an amphitheatre, upon a rising ground, and is distinguished at a considerable distance by the whitened walls of the houses. It is defended by a wall and a few forts, and garrisoned by about 150 sepoys. It contains some convents and a number of fine churches, which the Portuguese inhabitants attend on Sundays with great punctuality. On the east side is a pretty extensive quay, which affords a cool walk in the warm season, and in the vicinity of which the greater part of the Europeans have their residence. Others, however, occupy the west part of the town, from which they have a view of the port, and of a remarkable island called the Green isle, which is completely covered with trees, and finely contrasted with the arid and naked mountains, by which it is surrounded. It was upon this island, that the Jesuit missionaries first took up their abode, and passed over, during the night, to preach to the Chinese; but it is now entirely desolate, the church in ruins, and the garden laid waste.

Tchao-tcheoo-foo.

Tchao-tcheoo-foo, the second city in the province, is delightfully situated between two navigable rivers, abounding in fish, and is surrounded by fertile fields, rich in fruits, pasturage, and rice; but the air is unhealthful, and contagious distempers are very prevalent and fatal, particularly from the middle of October to the beginning of December. In its neighbourhood is a celebrated monastery of the Bonzes, which is supposed to have existed 800 or 900 years, and it was at this city that the British Embassy found young girls employed in the management of the ferry-boats. The town is about half the size of Canton, and contains about 10,000 families. The principal manufacture is nankeen stuffs, and the principal article of trade is a kind of oil, extracted from a plant named *tcha-tchoo*. This place is about 77 leagues distant from Canton, and is surrounded with walls, which are old and ruinous. Kao-tchoo-foo is likewise finely situated, in a fertile country, and is remarkable chiefly for a singular kind of stone, found in its vicinity, resembling marble. The veins have so much the appearance of trees, mountains, and rivers, that the slabs into which it is cut for tables, and other pieces of furniture, seem to have a multitude of landscapes painted upon them. Crabs, resembling those of Europe, are caught upon the coast near the town, but they are said to become petrified as soon as taken out of the water. Lien-tcheoo-foo possesses a convenient harbour, and is situated on the borders of the kingdom of Tunkin, from which it is separated by inaccessible mountains. Louitcheoo-foo is separated from the island of Hai-nan, by a narrow strait, in which pearls are said to have been formerly fished. The other cities of this province are surrounded with a rich country, and carry on considerable trade, but have nothing particularly deserving of notice. The island of Hai nan, which is within the jurisdiction of this province, is one of the largest islands of Asia. It is about 70 leagues in length from east to west, and 45 from north to south. Its capital, Kuin-tcheoo-foo, stands upon a promontory, and the ships come to anchor under its walls. Part only of the island is under the dominion of the Chinese; and the mountainous districts have still preserved their independence. These unconquered tribes used to carry on a considerable traffic with the Chinese subjects; but all intercourse with them has been prohibited. They are of a copper colour, very diminutive in stature, and deformed in person, but are extremely dexterous in the use of the bow and arrow. The island produces dragons-blood, cotton, areca, and a variety of valuable wood, of which the most esteemed is called rose-wood, on account of its smell, and is reserved for the sole use of the emperor. Among the animals which it contains, is a species of black ape, which is said to bear a most striking resemblance to the human features and form; and a number of curious birds, especially crows, with a white ring around the neck, and blackbirds of a deep blue colour, with yellow ears.

Island of Hai-nan.

The province of Quan-ton is one of the most considerable in the southern part of the empire, remarkably fruitful, and finely diversified with plains and hills. In the south, from the city of Canton to the village of San-tchoui-hien, a space of 30 leagues, the river is bordered with fine open plains, in a high state of culture; but from this place to Han hiong-foo, are lofty and romantic mountains, sometimes approaching close to the banks, and abounding in numerous quarries and collieries. The soil is dry, clayey, sandy, and of a yellowish colour, but often red, upon a bottom of clay. It produces rice, sugar, indigo, tobacco, cotton, silk; gold, tin, copper, mercury, marble, saltpetre, pearls, and precious stones; aromatic woods, particularly rose wood, eagle-wood, iron-wood, and the common kinds of tea. Besides most of the fruits of Europe, and several which belong to India, it yields some which are peculiar to itself, viz. the leetchee, and the long y-ven, the former of which is of a heating nature, and has a taste like that of a soft insipid onion; the latter is more of a cooling nature, and resembles the taste of musk. At the city of Canton the temperature is very high, especially in the months of August and September. In November, December, and January, there is a considerable degree of cold, so as sometimes to produce ice, but there is very rarely seen any snow. The coasts of this province abound in fish, oysters, crabs, and tortoises of immense size. Prodigious numbers of tame ducks are raised by the inhabitants, and are generally hatched in ovens and dunghills. They are put into small barks, carried down to the shore to feed upon shell-fish, and are collected at night by the sound of a bason, each flock returning to its own boat. The Chinese salt the flesh of these fowls, so as to preserve its original flavour; and prepare the eggs, by covering them with a coat of clay, mixed with salt. The air of this province is pure, and the inhabitants healthy, industrious, and imitative in the highest degree; but more insolent and contemptuous towards foreigners, than in any other province of the empire.

Fo-kien.

VIII. Fo-kien contains 9 cities of the first class, and 63 of the third. Foo-tcheoo-foo, its principal city, is distinguished by the beauty of its situation, the convenience of its port and rivers, the number of its learned men, and the magnificence of its bridges. Tsuen-tchoo-foo is nearly equal to the last-mentioned city in respect of beauty and advantages; but is particularly remarkable for a fine temple and a singular bridge. The former is adorned with two lofty towers, seven stories high, built of stone and marble, and having a gallery at each story, around which a person may walk, and view the beauties of the city and country. The latter, which is both of an extraordinary size and singular construction, is built of a blackish-coloured stone, and instead of arches, has about three hundred stone pillars, formed with acute angles on their sides, to break the force of the stream. Five stones, of equal size, laid transversely from one pillar to another, form the breadth of the bridge, and each of these stones is said to be about 18 yards in length. Of these there are 1000, all of the same size and figure. On each side of this bridge are buttresses of the same stone, with figures of lions, &c. on the tops, and in the middle of the bridge is built the castle of the city. Kien-ming-foo is mentioned in the Chinese history as having sustained two sieges at the conquest of the country by the Tartars; and its inhabitants, obstinately refusing to submit to the victors, were all put to the sword. Yen-ping-foo is built on the side of a mountain, and defended by the high hills in its vicinity, and so situated, that all the boats of the province must pass close by the foot of its walls, upon the river Min-ho. Tchan-tcheoo-foo, a place where the missionaries pretend that they found some vestiges of the Christian religion, and which carries on a very extensive trade with the isles of Emoy, Pong-hoo, and Formosa. It is situated upon a fine river, over which there is a large bridge of 36 arches, and so broad as to admit of shops on each side, which are stored with the richest merchandize of China and India. The small island of Emoy, or A-mwy, or Hia-men, is in the province of Fo-kien, contains a magnificent pagoda, sacred to the god Fo, and has an excellent harbour, capable of containing some thousands of vessels, with so great depth of water, that the largest ships may anchor close to the shore without danger. It was much frequented by European traders at the beginning of the last century, and the Chinese emperor kept in it a garrison of six or seven thousand troops. The isles of Pong-hoo, which are also in this province, form a kind of Archipelago between Emoy and Formosa, but they are little better than mere rocks or sand-banks, and the inhabitants must import every necessary of life. They furnish, however, convenient harbours to the ships visiting Formosa; as that island possesses no port, which is capable of admitting any vessel that draws above eight feet of water.

Island of Emoy.

The province of Fo-kien, though not of great extent, is very rich and flourishing. Its climate is warm, and its air healthful. Its mountains are numerous, but covered with forests, or cut into terraces, and carefully cultivated. Its productions are copper, tin, mercury, steel, iron, musk, crystal, silk, black-teas, linen and cotton stuffs, sugarcandy, a variety of wood, excellent paper, and pencils. It contains precious stones, and gold and silver mines, but these are not allowed to be opened. It carries on a very extensive trade with Japan, Formosa, Java, Siam, Camboya, and the Philippines; and its vessels of all descriptions are exceedingly numerous. It was formerly a separate kingdom, and its inhabitants still speak a great variety of dialects.

Tche-kiang.

IX. Tche-kiang, or *Tse-kian*, contains 11 cities of the first class, 72 of the third, and 18 fortresses, which may be accounted as towns. Hang-tcheoo-foo, the capital of the province, is regarded by the Chinese as an earthly paradise, and is one of the largest, richest, and best situated cities in the empire. It is said to be four leagues in circumference, exclusive of its suburbs; and its inhabitants are computed at one million, of which one thousand are employed in the manufacture of silk. Its streets are narrow, but well paved with broad flag-stones. They are full of very large shops and warehouses, stored with English broad cloths and peltry, in some of which not less than ten or twelve persons are serving behind the counter. The shops of the apothecaries and perfumers were particularly noticed by M. De Guignes, as finely ornamented; and he observed also numerous triumphal arches, adorned with figures, which had the appearance of being cut in stone, but which he concluded, from one that was broken, to be formed of some composition. A small lake, called See-hoo, washes its walls on the western side, and adds greatly to the beauty of the place. The water of this lake is clear as crystal, full of eels and other kinds of fish, and its banks covered with flowers. Open galleries, supported by pillars, and paved with large flag-stones, are erected along its sides for the convenience of walking; and causeways, cased with cut stones, traverse the lake in various directions, having numerous openings, covered with handsome bridges for the passage of the boats. In the middle of the lake are two islands, in which a temple and other houses of entertainment are erected for the reception of those who amuse themselves in the place. "Its natural and artificial beauties," says Mr Barrow, "exceeded every thing we had hitherto an opportunity of seeing in China." The surrounding mountains are lofty and picturesque; the vallies clothed with trees, especially the camphor-tree, tallow-tree, and arbor vitæ, (the first a bright green, the second purple, and the third a deep green colour), and varied and romantic sepulchres are seen in avenues among the trees, surrounded with cypress. Parties of pleasure in barges are frequently formed on the lake, but few females, except those of loose character, join in those excursions. Kia-king-foo, is remarkable for its fine streets, which are furnished with beautiful piazzas to shelter the passengers from the sun and rain. Hoo-tcheoo-foo, is situated on a lake of the same name, and is celebrated for the immense quantity of silk, manufactured within its walls. Ning-po-foo, called by the Portuguese Li-ang-po, or Liampo, is an excellent sea-port, on the east coast of the province, opposite to Japan; and about 20 leagues from the town, is the island of Tcheoo chan, where the English landed upon their first arrival in China, in the year 1700, as they were not able to find their way through the numerous islands on the coast to the port of Ning-po. The town is famed for its silks, of which it sends great quantities to Batavia, Siam, and particularly to Japan. Chao-hing-foo, is situated in an extensive plain, and in its vicinity is a very ancient sepulchral monument, which the Chinese consider as the tomb of the Great Yu. The inhabitants of this town and its district are said to be superior to most of the Chinese in their acquaintance with all the chicanery of the laws, and are generally preferred as secretaries to the higher mandarins. Tchu-tcheoo-foo, may be mentioned on account of the pine-trees, which grows upon a mountain in its neighbourhood to so extraordinary a size, that one of them will contain 40 men in the hollow of its trunk.

Lake See-hoo.

The province of Tche-kiang, extends from 28° to 34½° north latitude; and its mean temperature in the middle of November, was found to be from 56° at sunrise to 62° at noon. In the space of fifty leagues to the north of Hang-tcheoo-foo, the soil is clay upon a bottom of potters earth, the country level, and the mountains commence only in the environs of the city. For the space of sixty leagues, as far as to Tchan chan-hien, it is more or less mountainous, the soil sandy and reddish, like the stones on the hills. On the side towards Kiang-see, for the space of twelve leagues, it is mountainous, and the soil of a clayey nature. The province in general is in a state of high cultivation, and its population is immense. Its climate is healthful, its plains well watered, and its canals in good repair. On account of its maritime situation, its extent and population, it is one of the most considerable provinces in the empire; and was formerly the residence of some of the emperors. Its principal trade consists in silk stuffs, of which those kinds, that have gold and silver interwoven, are the most esteemed. Great numbers of silk worms are of consequence reared in the province; and whole plains are covered with dwarf mulberry trees for their support. These trees are purposely checked in their growth; as it is found by experience, that the worms, which feed on the leaves of the smallest trees, yield the finest silk. Notwithstanding the immense quantities exported to the other provinces of the empire, to Japan, Europe, and the Philippines, so much still remains, that a complete suit of silk may be purchased in this province as cheap as one of the coarsest woollen in Europe. The province produces, also, different kinds of wood, especially bamboo and the tallow tree; and mushrooms grow in such abundance, that they are pickled and dried; in which state they may be preserved a whole year, and when soked in water, become as fresh as at first. The province yields also, indigo, and is celebrated for the excellence of its hams. The inhabitants are said to be extremely superstitious, but they are lively, mild, and polite to strangers.

Kiang-nan.

X. KIANG-NAN, or *Nan-kin*, may be considered as the second province in the empire, and is divided into two parts, each of which has a distinct governor. It contains fourteen cities of the first class, and ninety-three of the second and third, besides innumerable towns and villages of considerable size and population. Kiang-

Nankin.

ning-foo, or Nankin, the capital, is said to have been, in former times, one of the most flourishing and splendid cities in the world, and is still the largest city in China. It is of a very irregular form, and is built upon several mountains, and its walls are said to be five and a half leagues in circumference; but it is spoken of in the most extravagant style by the Chinese, as having been, in ancient times, fifty and even ninety miles in compass; or, as they express it, so large, that, if two horsemen had set out in the morning, at one of the gates, and galloped round it in different directions, they would not have met till the evening. It was, at one time, the residence of the emperor, and was then called Nan-kin, or the southern court; but, in all public acts, it is now named Kiang-ning. Nearly one third part of it is now deserted by the inhabitants; and scarcely a vestige remains of the magnificent palace, observatory, temples, and monuments, which it once contained. Its gates are still beautiful, and a few of its temples are in good preservation, among which is one, called the Porcelain Tower, about 200 feet high, which is divided into nine stories, to the first of which there is an ascent of forty steps, and between each of the others a stair of twenty one steps. Near to Nankin is the broad and deep river Yang-tse-kiang, which furnished a commodious port to the city, but the navigation of which is now greatly neglected. In the months of April and May, great quantities of excellent fish are taken in this river, in the vicinity of the town; and, being covered with ice, are transported in boats to the court at Pekin. The streets of Nankin are narrower than those of most other Chinese cities; but are finely paved, and much more free from dust and dirt, than those of Pekin. It contains many learned men, valuable libraries, and extensive booksellers' shops; and its paper, ink, and other materials for writing and painting, are said to excel all others in the empire. The country around it is richly adorned with gardens, orchards, villas, &c.; but the most remarkable object in its neighbourhood is a wood of lofty pines, which is about twelve miles in circumference; and in the centre of which is a mound, rising above the forest, covered with temples and sepulchral monuments. Soo tcheoo foo, is the second city in the province, and one of the most agreeably situated in China. It is compared by Europeans to the city of Venice, with this difference, that the one is built upon the sea, and the other intersected by canals of fresh water. Its streets are narrow, and its shops present nothing remarkably striking. It is of great extent, and its walls inclose large portions of cultivated ground, with numerous fields and isolated buildings. It carries on a considerable commerce with Japan; and its brocades and embroideries, which are the principal manufactures of the place, are in great request, as being at once the finest and cheapest in the empire. The neighbouring country is delightful, the soil fruitful, the air temperate, the people polite; and the whole spot is called by the Chinese, the paradise of the world. Its inhabitants appeared to Mr Barrow to be more chearful, contented, and better clothed, than those of any other town that he had seen in China. The ladies, he observed, were dressed in petticoats instead of trowsers, which last was the costume in the northern provinces; and this city is one of the places where young women are carefully educated in singing, music, and dancing, to be sold as concubines to the higher mandarins. To the west of the city is a range of mountains covered with wood, and along their base is the extensive lake Tai hoo, famed for its fine fish and picturesque scenery. Tchan-tcheoo-foo, is situated near the canal, through which all the boats from Soo-tcheoo foo to Nankin must pass. It is celebrated for the excellence of its water, which is said to give a peculiarly pleasant flavour to tea, and for a kind of earthen ware, made in the district, which is supposed to have a similar effect, and is therefore preferred by the Chinese to the finest porcelain. Hoai-ngan foo, is remarkable chiefly for its situation in a marsh, and stands upon ground lower than the canal which surrounds it. It is thus in continual danger of inundations (to guard against which, it is inclosed by a triple wall;) but notwithstanding its hazard from the waters, it is sufficiently populous and full of trade. Yang tcheoo-foo, is a city of considerable extent, intersected by numerous canals, and provided with a multitude of bridges. The quay is formed of layers of straw and earth; and the place is crowded with boats, a great proportion of which are employed in conveying salt, which is the staple commodity of the city. There are several pagodas in the town and its neighbourhood; but, though the descriptions given of it by the Jesuit writers, are highly magnificent, M. De Guignes pronounces the house of the Hoo-poo to be the only building worthy of notice. It bears the marks, however, of great antiquity; and contains numerous ruins, overgrown with moss and creeping plants, which indicate that its grandeur has greatly decayed. In its neighbourhood, is one of those royal residences, which are provided for the accommodation of the emperors, as they pass through the empire; and which was built by the Emperor Kao-tsoo of the dynasty of Sooee. It is named Kao-min-chee, and consists of a tower, close by a pagoda, and surrounded by buildings, pavilions, and gardens. The tower is described by De Guignes as one of the finest that he observed in China. It consists of five stories, with a covered gallery around the outside of each, and with sixteen windows in each story. It has eight sides, and eight gates, white walls, and the wood-work painted red, a large tree on the top, surrounded by a spiral of iron, and surmounted by a gilded ball terminating in a point. Hoei-tcheoo-foo, the most southern city of the province, and one of the richest in the empire, has mines of gold, silver, and copper, in its adjacent mountains; and its inhabitants, who are temperate, frugal, and enterprising, are famed for preparing superior tea, varnish, and engravings. Fong-yang-foo, is situated on a mountain, which overhangs the Yellow river; and incloses several fertile little hills within its walls. It was the birth-place of the Emperor Hong-voo, the chief of a dynasty, who designed to have made it the seat of his court, and gave it its present name, which signifies "the place of the Eagle's splendour;" but finding that the inequality of the ground, and the scarcity of fresh water, would prove insuperable inconveniences, he changed his purpose, stopped his intended improvements, and removed his residence to Nankin. Three monuments of great extent and grandeur still remain, viz. the tomb of the Emperor's father, a magnificent temple of the god Fo, and a tower in the centre of the city, of an oblong form, and about 100 feet high.

Island of Tsong-ming.

To this province belongs the island of Tsong-ming, which is separated from the continent by an arm of the sea, about six leagues broad, and which was formerly a mere sandy desart, to which criminals were banished, and left to their own resources. By the exertions of those persons, and the assistance of a few poor Chinese families, it was at first brought into some degree of cultivation, and is now a populous and tolerably fruitful spot. Its principal production is salt, which is extracted from a kind of gray earth in the following manner; the earth is first smoothed and raised in a sloping form, that the water may not settle upon it; and when the sun has dried its surface, it is removed and laid in heaps, which are carefully beaten on every side. It is then spread on large tables, a little inclined, and fresh water is poured upon it, which, as it runs off, carries along with it the particles of salt into a small canal, by which it is conveyed to a large earthen vessel. The earth, which has thus been freed from its salt, is thrown apart till it becomes dry, when it is again pulverized, and spread over the soil from which it was taken, when in a short time it is again impregnated with saline particles, which are again extracted as before. The salt-water, thus procured, is then boiled by the women and children, and put into large iron basons, which they continue to stir with an iron spatula, till the aqueous parts be evaporated. The extent of this island is about twenty leagues in length and five or six in breadth. It has only one city, which is of the third rank; but it is covered with villages, and intersected with canals.

This province extends from 31° to 34½° north latitude; and its mean temperature, from the 30th of October to the 9th of November, was found to be 54° at sun-rise, and 66° at noon: The sky at the same time was uniformly clear. The country is in general level, except in the neighbourhood of the river Hoang-ho. The soil, in the western part of the province, is a dry reddish clay; the banks of the river are a yellowish clay, and the eastern division is chiefly light and sandy, but towards the south-east there is more of a good clay, and often a black fat earth. It is much intersected by rivers and canals; and, being thus capable of being flooded in dry seasons, it is extremely valuable and fertile. Every part of it, also, has easy communication with the Yellow Sea, by means of the two great rivers Hoang-ho and Yang-tse-kiang; and it is thus considered as the central point of the home trade of China. Its cities are large, populous, and flourishing; and it is one of the most extensive, commercial, and wealthy provinces in the empire. Its silk stuffs, japanned ware, ink, and paper, are greatly valued; and in one village alone, with its dependencies, it is reckoned that 200,000 persons are employed in weaving cotton cloths. There are numerous salt-pits on the coast, which yield an immense revenue to government. The inhabitants are civil, ingenious, and apt in the acquisition of learning; and many of them have become eminent in the literature of the nation.

Shan-tong.

XI. SHAN-TONG, *Chan-tong*, or *Xan-tong*, contains 6 cities of the first class, and 114 of the second and third. Tsee-nan-foo, the capital, situated on the south of the river Tsee, is large and populous, and is much honoured by the Chinese, on account of its having been the residence of a long succession of sovereigns, whose tombs on a neighbouring mountain present a very striking view from the city. Kio-feoo is celebrated chiefly as having been the birth-place of the celebrated Confucius, or Kong-foo-tsé. Lin-tchin-tcheoo, situated on the great canal, is a place of much trade, and contains a remarkable octagonal tower, eight stories high, covered on the outside with neatly painted porcelain, and encrusted in the inside with variegated marble. All its cornices and projections are furnished with small bells, which, when moved by the wind, yield a pleasing sound; and in the highest story is placed an idol, of gilt copper, to which the tower is consecrated. Tsin-tcheoo-foo is celebrated for its immense traffic in fish, of which so great a quantity is caught in its vicinity, that the sale of their skins is said to yield a very considerable profit; and also for a yellow stone, produced in the belly of the cows in its district, which is as large as a goose's egg, brittle as crayon, and used in medicine. To this province belong several small islands, the greater part of which are provided with good harbours, which afford a convenient shelter to the Chinese junks that sail to Corea and Leao-tong.

This province extends from 34½° to 38° north latitude; and its mean temperature, from the 19th to the 29th of October, was found to be about 52° at sun-rise, and 70° at noon, with a constant clear and cloudless sky. The country is in general level; but towards the south it is full of mountains and swamps. The soil is a dry sand, of the colour of ashes, or rather a collection of mud and slime deposited by the rivers, and scarcely containing a single pebble; and there are large tracks of marsh and moss, which are inhabited only by a few miserable looking fisher-tribes. Very little rain falls in the province; but, besides its many lakes and rivers, which are highly useful in fertilizing its plains, it is traversed by the great imperial canal, which adds greatly to its wealth; as all the vessels, which transport such immense quantities of provisions and merchandise to Pekin, must thus pass through its territory. Besides the common silk worm, there is found in this province another insect, resembling the caterpillar of Europe, which produces a coarser kind of silk, of which however are made very strong and durable stuffs, which are in great request throughout China. It abounds also in grain of all kinds, especially wheat, rice, and millet. The inhabitants are accounted the keenest sportsmen in the empire, and are very strong and hardy. It is frequently infested by locusts, and the mountainous districts are much frequented by wolves.

Ho-nan.

XII. Ho-nan contains 8 cities of the first class, and 102 of the second and third, with a number of castles and fortified places. Cai-fong-foo, the capital, is situated at the distance of two leagues from the river Hoang-ho, upon ground which is lower than the river, and where strong dikes, to the extent of 30 leagues, were erected by government to prevent inundations. When it was besieged in 1641, by an army of 100,000 rebels, the general, who was sent to its relief, formed the design of drowning the enemy by opening these dikes. His plan was successful, as far as related to the opposing army; but the inundation was so sudden and violent, that the city also was overflowed, and 300,000 of the inhabitants destroyed. It is conjectured from its ruins to have been about three leagues in circuit; but though it has been rebuilt, its size is very limited, and it is distinguished from ordinary cities only by the extent of its jurisdiction. Tchang-te-foo, one of the most northern cities of the province, is remarkable for a fish in its vicinity which resembles a crocodile, and the fat of which is of so very singular a nature, that when once set on fire, it is scarcely possible to extinguish the flame; and for a mountain in its district, so steep and inaccessible, that, in time of war, it used to afford a secure asylum to the inhabitants. Ho-nan-foo, situated in a mountainous region, between three rivers, was formerly called by the Chinese the Navel of the Earth, because it is supposed to be exactly in the centre of their empire. It is famed for an ancient tower in one of its villages, which is considered as having been the observatory of the celebrated Chinese astronomer Tcheoo-kong, who is said to have lived 1000 years before Christ, and is affirmed by his countrymen to have invented the mariner's compass. They still show an instrument, which he is supposed to have used for finding the length of the meridian shadow, in order to determine the latitude. This province is situated nearly in the centre of the Chinese empire, and, in reference to its situation and beauty, is called Tong-hoa, or "the middle flower." The ancient emperors, invited by the mildness of the climate, and the beauty of the country, generally resided in it part of the year. Its abundant fruits, however, rich pastures, plentiful crops, cheap provisions, together with the effeminacy of its inhabitants, have prevented the progress of commerce in its territories. The eastern part is very flat, and finely cultivated, so as to appear like one immense garden; but towards the south-west it is more mountainous, and covered with forests. Besides numerous streams and fountains, it is traversed by the river Hoang-ho; and has a fine lake within its territories, the water of which is said to impart a peculiar lustre to silk, and the banks of which are therefore covered with the manufactures of that article. It produces fruits and grain of all kinds, silk, cinnabar, loadstone, talc.

Hoo-quang.

XIII. Hoo-quang, or *Hoo-koang*, is divided by the river Yang-tse-kiang into two parts, northern and southern; and contains 15 cities of the first class, 114 of the second and third, exclusive of numerous fortresses and villages. Voo-tchang foo, the capital, situated on the river Yang-tse-kiang, is the great resort of the commercial people of China. Its ports are crowded with vessels, sometimes covering the river for the space of two leagues; and every branch of trade is carried on within its walls. It is celebrated for its plentiful crops of fine tea, its manufacture of bamboo paper, and the beautiful crystals which are found in its mountains. Tchang-tcha-foo, the principal city of the southern division, is situated upon a large river communicating with an extensive lake; and is remarkable only for a festival, instituted in one of its dependent cities, in honour of a mandarin, one of its governors, which is still solemnized with great splendour throughout the empire, by sports, feasts, and combats on the water; but the latter part of the amusement, owing to the accidents with which they were frequently attended, have been in a great measure prohibited.

This province is generally level, and well watered by lakes, canals, and rivers. Its soil is rich and fertile in a high degree; and it is called the granary of the empire. It produces great quantities of rice, excellent cotton, paper, wood, crystal, talc, iron, tin, vitriol, mercury.

Koei-tcheoo.

XIV. Koei-tcheoo, or *Quei-tcheoo*, one of the smallest provinces of China, contains 10 cities of the first class, and 38 of the second and third. Koei-yang-foo, the capital, is said to have once been an imperial residence; and remains of temples and palaces still prove its ancient magnificence. Some of the other cities are situated in fertile vallies, and on the banks of pleasant rivers; but the province is, in general, a kind of desert, covered with inaccessible mountains. Its ancient inhabitants, a tribe of savage mountaineers, still preserve their independence; and the Chinese colonies on the lower grounds, obliged, by the dread of these depredators, to keep near the fortified places, are prevented from improving the soil to any great extent. All attempts to subdue these plunderers, and to secure the cities from their incursions, have been attended with very partial success. It is regarded, in short, as the Siberia of China, and its mandarins are generally disgraced nobles, whose family connections or former services prevent them from being altogether discarded from office. It has mines of gold, silver, copper, and quicksilver; and produces a species of hemp, which is made into cloth for summer dresses. It furnishes the best horses in China, numbers of cattle and hogs, and particularly wild fowl of exquisite flavour.

Kiang-see.

XV. Kiang-see contains 13 cities of the first rank, and 78 of the second and third. Nan-tchang-foo, has great trade, chiefly in porcelain, which M. De Guignes describes as sold remarkably dear; and is so much frequented, that Mr Barrow calculated, at the time of the British embassy passing it, that, independent of innumerable small craft, 100,000 tons of shipping lay around it. Its streets, however, as observed by M. De Guignes, were narrow and dirty, and few of its shops richly stored. In its neighbourhood is situated a celebrated temple, with a large well belonging to it, full of great snakes, which the priests exhort the people to worship as the children of dragons, which, if not appeased by sacrifice and offerings, would destroy the whole world. It is affirmed as a natural fact, that the appearance of these snakes upon the surface of the water always prognosticates rains and inundations, a circumstance which assists to support the superstitious reverence which is paid to them. Jao-tcheoo-foo, or Zhao-tcheoo-foo, situated on the northern bank of the lake Po-yang, is particularly celebrated for the beautiful porcelain, which is manufactured in a village of its district, called King-te-tching. This village is as populous as the largest cities in China, and is said to contain a million of inhabitants, crowded together in long narrow streets. It stretches along the banks of a fine river, which forms a harbour about a league in circumference, which is sometimes lined, throughout its whole extent, with a triple row of barks. All the provisions, which it requires, are brought from a distance; and even the wood, which is consumed by the furnaces, is carried about 100 leagues. It is, nevertheless, a general asylum to poor families; as children and invalids

Topography.

find employment suited to their strength, and even blind persons gain a subsistence by pounding the colouring materials. It is said to contain about 500 furnaces, all employed in making porcelain, the flames and smoke of which give it the appearance at night of a city on fire. Strangers are not permitted to lodge in the town, but must sleep in the boats, unless they have friends among the inhabitants, who become security for their conduct; a regulation which is supposed necessary in a place, which is so full of valuable articles, and so likely to attract plunderers. Lin-kiang-foo, situated on the banks of the Yu-ho, in a healthful climate and good soil, is so much deserted, that the Chinese have a saying, that one hog would maintain the whole of the inhabitants for two days. But one of its villages is a considerable market for drugs, and its neighbouring mountains yield great quantities of oranges, on account of which articles it is held in some repute. Kang-tcheoo-foo, a populous and flourishing city, situated at the confluence of two rivers, has a bridge of 130 boats, joined together by iron chains, and upon this bridge is built the custom-house. Two or three of the boats are left moveable, in such a manner as to afford an opening, when necessary, for vessels to pass up or down. In the neighbouring country is found abundance of those trees, which yield the varnish used in japanning, and which are supposed to be the *Rhus Vernix*.

This province extends from 28° to 30° of north latitude; and its mean temperature, in November, was found to be from 56° at sun-rise, to 62° at noon. It is full of rivers, lakes, and marshes towards the north; but rather mountainous in the south. The soil is, in general, a dry reddish, occasionally yellowish, sand, upon a bottom of clay; and in some spots was observed a depth of six feet of vegetable earth; but around the Po-yang lake, which is in this province, the country is a continued marsh for an immense extent. It produces excellent rice, with which several barks are annually loaded for the use of the court; but wheat and sugar-cane are the chief crops, the latter of which is peculiarly juicy, and has joints from six to nine inches in length. Though sufficiently fertile, it is so very populous as to be unable to supply its inhabitants, who are, on that account, extremely economical, and accustomed to very spare diet. Hence they are exposed to the raillery of their neighbours; but they are said to be very acute and intelligent, and readily rise to the higher dignities in the state. Its mountains are covered with medicinal herbs; and contain also gold, silver, iron, lead, tin, vitriol, alum, and crystal. It furnishes also, as articles of trade, tallow, paper, and varnish. The women of this province are more robust than those of most other parts of China; are strangers to the custom of cramping the feet, and are much employed in the labours of the field. When a Chinese farmer, therefore, is in quest of a working wife, he goes to purchase in Kiang-see.

Number of towns, &c. in the empire.

According to the flaming statements of the Chinese, the whole cities of these 15 provinces amount to the number of 4402, divided into two classes, civil and military; the frontiers and sea coasts are defended by 439 castles, well fortified, and covered by 2920 towns, many of which are equal in population and extent to the walled cities; while the villages, scattered over the interior, are declared to be innumerable. There are also, according to the same authorities, 1145 royal hospitals, or lodging places, for the officers and servants of the court; 1159 triumphal arches, erected in honour of kings and heroes; 208 monuments, dedicated to the memory of females, who have been distinguished by the virtues of their sex; 272 libraries, continually open to the learned; and in almost every city or town, schools and colleges, established by Confucius, or founded in honour of his name.

Topography.

Tributary states.

The other parts of the Chinese dominions and tributary states, viz. Chinese Tartary, the island of Formosa, the kingdoms of Corea, Tunkin, Cochin-china, Thibet, Hami, and the isles of Lieoo-kieoo, will form the subject of separate articles. But we may here shortly notice those distinct and almost independent tribes, who reside within the limits of the Chinese empire, and may, indeed, be classed among its subjects; but who are still so different, in many respects, from the other inhabitants of the country, as to require a separate description.

Sifans.

1. The SIFANS or *Toopans*, whose country is situated to the west of the provinces Chensee and Se-tchooen, between the 30° and 35° of north latitude, and forms a continued ridge of mountains covered with snow, even in the month of July, inclosed by the rivers Hoang-ho on the north, Ya-long on the south, and Yang-tse-kiang on the east. They are divided into two tribes, called by the Chinese, from the different colours of their tents, the black and the yellow Sifans. The former are a miserable uncivilized people, who live in small bodies, governed by petty chiefs, who are all dependent upon one as their head. The latter are ruled by a family of princes, or rather priests of the god Fo, who have each a separate district; and the oldest of whom is styled Lama, and is distinguished by a yellow dress. The payment of certain honours, and of the dues to the idol divinity, which are not very burdensome, is all that they exact from their subjects. A few of the Sifans have houses of earth or brick; but the greater part live in tents, in small hamlets of five or six families. Their chief occupation is the rearing of their flocks, and a traffic in rhubarb, which their country produces in great abundance. Some of their rivers wash down particles of gold among the sand, of which they form small vases and statues; and with the general use of which, they seem to have been long acquainted. They were once, it is said, a powerful nation, whose dominions extended to the boundaries of Cachemire, and often proved formidable enemies to their Chinese neighbours. But since the year 1227, they have been confined within their native mountains, and have sunk back into their original barbarism. They still maintain a proud and independent spirit, acknowledging, with reluctance, the supremacy of the Chinese emperors, and seldom obey the edicts of the mandarins; but the government of China connives at their disaffection; and endeavours, by mild measures, to preserve in some degree of subjection, a people, whose frightful mountains would enable them to defy all attempts to reach them by force.

Lo-los.

2. The LO-LOS, who are dispersed through the province of Yun-nan, were formerly governed by their own sovereigns; but submitted to the Emperor of China, upon condition of enjoying for ever the honour of mandarins, with which office accordingly the head of every family is invested. They are ruled by princes of their own nation, who govern them in a very despotic manner, and have the power of punishing with death, without the concurrence of the Chinese viceroy. These princes have numbers of officers attached to their respective services, and can appoint the commanders of their own troops. These people are a well made and very hardy race. Their dress consists of plain drawers, a cotton vest, which reaches to the knee, a straw hat, and sandals on their feet, but no covering to their legs. The women wear a long robe, covering the whole body, and descending to the feet, above which is fastened a small cloak reaching to the girdle; and in this dress they appear on

horseback, at visits, marriage ceremonies, &c. attended by their female servants, mounted in like manner. Their princes dress in the Tartar style, and generally make use of silk stuffs. The Lo-los have a language of their own, and their mode of writing resembles that of the Bonzes of Pegu, who have acquired the favour of the most powerful families in the western part of Yun nan, and introduced among them the religious worship of their own country.

Miao-tse.

3. The Miao-tse, or *Mountaineers*, is a name given to several tribes, who differ in some respects from each other; but who, like the Lo los, are governed by their own princes, who have a royal household, officers, and militia, of their own appointment. They are a half civilized people, dispersed through the mountainous districts of the western provinces, and often make predatory incursions upon the level country. They are armed with bows and half pikes, and are very dexterous horsemen. Their horses are remarkable for the agility with which they climb the steepest mountains, and are highly valued in China. Those who are candidates for any office of command among them, are required to prove their horsemanship, by riding at full speed down the steepest places, and by clearing at one leap ditches of considerable width, in which fires are kindled. The Chinese consider these people as sufficiently subdued, if they can confine them within their mountainous districts; and for this purpose, they have erected around them numerous castles and fortresses strongly garrisoned. Those, who inhabit the province of Koei-tcheoo, are rather more civilized than the other tribes, dwell in houses built of brick, form themselves into villages, cultivate the soil, manufacture carpets and coarse muslin, and float considerable quantities of timber down their rivers, which they exchange with the Chinese for oxen, cows, buffaloes. Their ordinary dress is a pair of trowsers, and a kind of jacket which laps over the breast. They wear a strong and weighty breast plate of hide, covered with laminæ of steel or copper. Those who inhabit the southern part of the province of Hoo-koan, are equally independent as the rest of their nation, but profess to acknowledge the authority of the mandarins. They are remarkably hardy and active, and run bare-footed over the roughest grounds and steepest rocks. Their young women wear a singular kind of head-dress, consisting of a small board, about a foot in length and five or six inches in breadth, over which they spread their hair, and fix it to the wood with wax. This wax is melted at the fire, and the hair combed, cleaned, and arranged anew, three or four times a year. Those, who reside in the more central parts of this province, are in a great measure subject to the Chinese, whose manners they have entirely adopted, and from whom they are distinguished only by a peculiar covering of the head. The whole Miao-tse race are regarded by the Chinese with the utmost contempt, and are represented by them as a barbarous set of banditti; but the missionaries always speak of them as an active, laborious, civil, and honest people. On their part, they have an equal detestation of the Chinese, whom they consider as severe and oppressive masters, who would be unable to subdue them if they were united, but who contrive to keep them shut out from communication with one another. These tribes, after having preserved their independence almost 2000 years, were at length reduced to a state of subjection by the defeat of their two most formidable states on the frontiers of Se-tchuen, and Koei tcheoo. Having committed some devastations upon the territories in their neighbourhood, about the year 1752, the Emperor Kien-long, resolved to accomplish their subjugation, and, after a tedious war of 25 years, they were finally reduced in 1776, by the skill and perseverance of the Chinese general, Akouee. The Miao-tse defended themselves with determined valour, and even their women are said to have fought with the most obstinate fury, of which the following instance has been recorded. A party of Chinese soldiers, during the space of two months, had employed, in vain, every method of force and stratagem to gain possession of a small fort on the summit of a high rock. One morning, about day-break, their guard was alarmed by the sound of footsteps, as of a person treading with great caution; upon approaching silently the place from which the noise proceeded, they perceived something indistinctly in motion; and some of the most active, having scrambled up the rock, by the assistance of cramp irons on their feet, discovered a woman drawing water. Having seized and questioned her, particularly with regard to the strength of the garrison, which had made such resistance, "I," she replied, "I alone; but being in want of water I came hither, not expecting to meet with you." She then pointed out to them a secret path, by which they reached the fort, of which she had been the sole defender, sometimes by firing her musket, and at other times by rolling down fragments of the rock, upon those whom she observed attempting to ascend.

Jews.

4. The Jews, of whom a numerous colony, according to their own account, and to the records of the Chinese, entered China about the period of Alexander's expedition to India; and are supposed to have been a part of the followers of his army. They reside chiefly in the provinces where silk is manufactured, especially in the city of Hang-tchoo-foo; and it is conjectured to have been chiefly owing to their skill in preparing that article, perhaps to their having originally introduced the use of it into the country, that they have recommended themselves so much to the notice of the government, as to have obtained a variety of privileges, and to be allowed even to intermarry with the natives. In one of their synagogues the missionaries found a copy of the Pentateuch, and some other fragments of the sacred writings; but except their rabbis, they have now no knowledge of the Hebrew language; and had never heard of any other Jesus than the son of Sirach. Many of them are said to have forsaken their own religion, at least in appearance, and to have arrived at high offices in the Chinese government.

History.

The knowledge of the origin, history, and condition of this extensive and extraordinary empire is still extremely imperfect and uncertain. It was only at a late period that the nations of Europe became acquainted even with the existence of the country; and even then, the peculiar nature of the language, and the careful exclusion of foreigners by the government, prevented, and still in a great measure prevent, that degree of intercourse with the people, which is necessary to procure correct information of their manners, and free access to their historical records.

Origin.

With respect to their origin, it has been conjectured, from the coincidence between several of their tenets and the mythology of the ancient Egyptians, that they are descended from an Egyptian colony; but, on the other hand, it is asserted, that there is no resemblance between the Chinese and the Egyptian features, and no appearance of the former having become, in later times, a mixed race. It is conceived, that the vestiges of Greek and Egyptian superstitions, still found in China, may be ascribed to the wanderings of those exiled Greeks and

Egyptians, whom Ptolemy Physicon expelled from Alexandria, and who travelled eastward to seek a refuge among the Persians and Indians. There is perhaps a still greater analogy between many of the Chinese nations and customs, and those of the Hindoos and other Indian nations; as, for instance, in their predilection for the number nine, in their observance of solstitial sacrifices, in their practice of making offerings to the *manes* of their ancestors, in their dread of leaving no offspring to perform their funeral obsequies, in their manner of dividing the zodiac, and of distinguishing eight instead of four cardinal points of the compass. But, notwithstanding these moral coincidences, as they may be called, there is understood to be strong physical evidence of the Chinese being descended from a stock entirely distinct from the Egyptian, Greek, or Indian; and their peculiar features are represented by intelligent observers, as decidedly of what is called the Tartar cast, which is found to prevail on the continent of Asia, from the tropic of Cancer to the Frozen Ocean, appearing first in Bootan, and spreading thence over the peninsula of Malacca, and the multitude of Malay and Japan islands; and which is conjectured to have been transmitted, with little intermixture, from the earliest tribes of mankind after the deluge.

Antiquity.

The Chinese themselves, indeed, have advanced the most extravagant claims with regard to the antiquity of their nation; and pretend to trace back their history to a period, far anterior to the Scripture date of the deluge, and even of the creation. Some of them have ascended in their flight more than ninety millions of years before the Christian era; and till very recently, the greater part of European authors were disposed to regard them, as having possessed a stable and civilized government, about 3000 years before the birth of Christ. It has been supposed, that Tartary, as being the highest ground on the globe, was the seat of the family and descendants of Noah immediately after the deluge; that Moses, by Mount Ararat, does not mean any particular mountain of that name, but only the highest mountain on the face of the earth; that the ark, therefore, rested on some of the elevated tracts inhabited by the Eleuths, from which flow a number of large rivers corresponding to those mentioned in the Scripture history, namely the Solenza, which falls into the lake Baikal and the Frozen Ocean, the Amour, which carries its waters eastward to the gulf of Tartary, and the two great rivers of China which flow southward; that Noah may be conceived to have followed the course of these last mentioned rivers, as leading to a fertile and open country, and that he was thus the actual founder of the Chinese monarchy, and the same with the Fo-hee or Foo shee of their history. This opinion, which was proposed by the learned Shuckford, is very keenly and ingeniously supported by the authors of the *English Universal History*; and their argument is founded upon a fact mentioned in the Chinese annals, as having taken place in the reign of Yao, their seventh monarch from Fo-hee, namely, that "the sun did not go down during the space of ten days." This they conceive to be the miracle recorded by Joshua; and, as Moses reckons seven generations from Noah to Joshua exclusive, namely, Abraham, Isaac, Jacob, Levi, Kohath, Amram, and Moses, corresponding to the seven reigns reckoned in the Chinese history between Fo-hee, and Yao inclusive, they contrive to make out the following result.

	Year of the Flood.	Before Christ.
1. *Noah*, called by the Chinese *Fo-hee*, justly offended at the impiety of his rebel offspring, separated himself from them a little before the building of the tower of Babel, and steering his course eastwards, at the head of a select number of adherents, after 200 years peregrination, settled himself and them in one of the northern provinces of China.	235	2114
Here, having settled his colony, and established among them the religion, laws, and government, and imparted to them all the branches of learning, which he had received from his antediluvian ancestors, he died in the 115th year of his reign and 950th of his life, and was succeeded by	350	1999
2. *Shin nong*, alias *Zing-nung*, who greatly improved those arts and sciences left behind by Noah; and, after a reign of 140 years, left the crown to	490	1859
3. *Whang tee*, alias *Hoang tee*, the inventor of the Chinese arithmetic and other arts. He reigned 100 years, and was succeeded by	590	1759
4. *Shau-hau*, alias *Xao-hau*, who reigned 84 years, and left the crown to	674	1675
5. *Chwen hyo*, alias *Chuen-hiou*, who reigned 78 years, and was succeeded by	752	1597
6. *Ti-ko*, alias *Cous*, who reigned 70 years, and was succeeded by . . .	822	1527
7. *Chee*, who, after a reign of eight years, was deposed, and the crown given to his brother	830	1519
8. *Yau*, in the 67th year of whose reign, according to the Hebrew chronology, happened the miraculous solstice, mentioned in the book of Joshua, and in the Chinese annals, though without any year being specified.	897	1452

A more moderate and rational statement is given by Mr Barrow on the subject, of which the following is the substance; that, though the Chinese should be admitted to have been among the first nations after the flood, yet they do not appear to have made such progress in arts and learning, as the Chaldeans, Assyrians, and Egyptians; that it is only from the time of Confucius, (200, or according to others, 550 years before Christ,) that they seem to have advanced in civilization; that, previous to his time, the country was divided into a number of petty kingdoms, under separate chiefs, with a recital of whose reciprocal wars and struggles for superiority, the Chinese annals are chiefly filled; that their historical records are sufficiently abundant and complete, during the last 2000 years, and the transactions of each reign fully detailed without interruption, down to the present time; and that, during this period, the empire of China has been less disturbed by foreign wars or intestine commotions, than any other portion of the world, of which we possess any accounts. Even from this more judicious view of the subject, however, very great deductions must be made; and the authenticity of these sources, from which the Chinese profess to draw their early history, must be considered as more than questionable. Besides a variety of strong presumptions against their credibility, a simple examination of these documents themselves, and of the account of their origin given by the Chinese, is more than sufficient to discredit their whole pretensions to a remote antiquity. Their story is as follows.

Historical records destroyed.

A great diversity of the characters used in writing had begun to prevail in very early times; and the successive Chinese emperors had attempted in vain to reduce them to one uniform and intelligible system. In this, however, they experienced the utmost difficulty, both from the obstinacy of the learned men, who were attached to the different modes of writing, and from the refusal of the chiefs of the different provinces to obey the imperial mandates on the subject. At length the Emperor Shee-hoang-tee, after many bloody wars, having united the supreme authority in his own person, commanded his prime minister, Li-sé, to enter upon the reformation of the written characters. Li-sé, with the assistance of two of the literati, reduced to the number of 10,500 the characters used in medicine, agriculture, and astrology; but found himself utterly unable to introduce the new characters into general use. As the only measure, which could ensure the accomplishment of this object, he advised the emperor to cause all the books to be burned, except those which treated of medicine, agriculture, and divination, and the history of the dynasty of Tsin (from which the emperor himself was descended); and to punish with death all, who should in any respect oppose the execution of this decree, or refuse to employ henceforth the new system of characters. The emperor approved of the plan, and caused it to be put into execution with the utmost severity. The condemned writings, or rather characters, were collected under the heaviest penalties from all quarters of the empire; and about four or five hundred learned men were put to death in the course of this literary persecution. This event took place 213 years before the birth of Christ. About forty years afterwards, the Emperor Ven-tee was desirous to recover the historical documents, especially a work of Confucius called Shoo-king; and an old man was found, who furnished several portions of it from memory. In the reign of Voo-tee, about 150 or 140 years before Christ, some fragments of the ancient books were discovered, which had escaped the general conflagration, and which had been preserved in the ruins of a house, which had been inhabited by some of the descendants of Confucius. One of these was the book Shoo-king, written on tables of bamboo, but greatly destroyed in many places. By putting together, however, the legible portions, and patching them up with the fragments formerly procured from the mouth of the old man Foo-cheng, they restored, as they pretend, 58 chapters of the works which originally consisted of 101; and this has continued to be the sole foundation of the ancient history of China. By the assistance of this document, and a few other imperfect historical memoirs, an author named Se-ma-tsien, produced the first complete history of China, about fifty, or as some say, ninety years before Christ; but he has himself the candour to acknowledge, that he was not able to ascend with certainty more than 800 years before the time in which he wrote; and, according to father Prémare, he is regarded by the greater part of the Chinese authors, as a mere fabler. There was afterwards discovered another work of Confucius, named Tchun-tsioo, which carries the history, however, no farther back than the year 722 before Christ; and, about the year 265 of the Christian era, a small piece upon chronology was found, which begins with the reign of Hoangtee, and ends with the dynasty of Tcheoo, or the year before Christ 782; but it is merely a list of emperors without dates, and with a few notices of events.

Uncertainty and deficiency of early annals.

Such is the account given by the Chinese of the complete destruction, and partial restoration of their most ancient historical records; but it is regarded by many of the most judicious writers on the subject, as altogether a fable, invented at some modern period as an apology for their want of annals to support their pretensions to a remote antiquity; or if true, it affords equally sufficient proof, that no well authenticated ancient document of their history is in existence. Even those ancient records, which they consider as the foundation of their early history, especially the surviving chapters of the Shoo-king, admitting these documents to be both genuine and authentic, are meagre and imperfect beyond what any one will easily be able to conceive, who has heard only of those hyperbolical descriptions of the antiquity and history of China, which have been so long current in Europe. The Shoo-king itself makes mention only of twenty Emperors, and these, too, not in regular succession from one another; but one here and there only, in periods of thousands of years, with frequently no other circumstance, but merely the name. It begins with Yao and Chun, then proceeds to the first dynasty, named Hia, of which only five are named of the 17 emperors, of whom it is said to have consisted. Of the 28 emperors of the second, only five also are noticed; and of the third, down to the reign of Ping-vang, 770 years before Christ, only six are recorded out of fourteen. There is besides in the whole book no epoch mentioned, no dates given, no account even of the duration of the several reigns, except those of five or six princes. Instead of the regular series of astronomical calculations, upon which the ancient Chinese annals are supposed to be founded, and which are understood to have been verified by the calculations of the most eminent modern astronomers, the Shoo-king mentions only two eclipses, and two observations of the solstices, in the space of the first fifteen hundred years of their history; and these also are recorded in such an obscure manner, with so little detail of circumstances, without even the year of the emperor's reign, or the day of the cycle, on which they took place, that modern astronomers have no foundation whatever, upon which to proceed, in fixing the time of these phenomena. It is only from the year 722 before Christ, that their observations begin to multiply; and, from that period to the year 480 before the Christian æra, Confucius has mentioned, with sufficient chronological exactness, 36 eclipses, of which 31 at least have been found completely conformable to astronomical calculation. It has been remarked, as rather a curious circumstance, that this æra of 722 before Christ, at which alone the Chinese chronology commences with any degree of certainty, coincides nearly with the famous æra of Nabonassar, which is placed in the year 747 before Christ, and which forms the basis of the Grecian calculations; and it has been conjectured, that Confucius may have been acquainted with these astronomical observations made at Babylon, when he gave to the Chinese astronomy so sudden, and so great improvements.

The early history of China, besides being derived from such uncertain sources, is so extremely limited, as scarcely to deserve the name. Of the immense collection, known in China by the name of the twenty-one historians, which consists of about 500 volumes, the first 14 volumes comprehend the whole historical memoirs, from the reign of Yao, to the year 200 before Christ; and seven of these 14 contain only genealogical tables. An abridgment of Chinese history of high authority, named Tong-kien-kang mo, as examined by M. De Guignes, presents the following proportions. Of 56 volumes, the half of the second, namely 75 pages, and the whole of the third, namely 111 pages, loaded with notes larger than the text, and consisting chiefly of long moral discourses from the Shoo-king, comprizes the history of the empire, from the reign of Yao to the commencement of the third dynasty, a period of about 1236 years. The history of the third and fourth dynasties, reaching to the year before Christ 207, occupies nine volumes; and the remaining 44 contain the history, from 207 before the Christian æra to the year of Christ 1368.

Such is the general character of the early Chinese history; not as has been pretended, consisting of regular annals, ascending without interruption 3000 years before Christ, written by contemporary authors, full of circumstantial details, and founded upon the most exact astronomical observations; but, on the contrary, extremely limited and ill connected; destitute of events, and full of contradictions; resting upon the most questionable authorities, and often upon mere conjecture; drawn up by authors, who lived far posterior to the times which they describe, and who are frequently divided into the most opposite opinions, and contradictory accounts. We proceed, however, to present our readers with a short sketch of what these historians have recorded; and during the earlier and most doubtful periods, we are happily furnished with a summary of ancient Chinese history by M. de Guignes, drawn from actual inspection of the original materials. That we may occupy as small a space as possible with what is so very uncertain and uninteresting, though necessary to be known as a portion of acknowledged history, we shall merely present a chronological view of each dynasty; and without noticing the progress of every reign, shall content ourselves with selecting the most remarkable events of the period.

First Emperors of China.

	Before Christ.		Before Christ.
Fo-hee	2953	Ti-ko	2436
Shing-nong	2838	Ti-tchee	2366
Hoang-tee	2698	Yao	2357
Shao-hao	2598	Shun	2255
Tchuen-hio	2514		

Before Christ 2953.

Prior to any of these emperors, several chiefs are named in the Chinese annals, who first attempted to civilize the savage natives of the country; but Fo-hee is universally considered as the first, who possessed the title and authority of a sovereign in China. The commencement of his reign is fixed by some of the Chinese historians as high as the year 3300 before Christ; but the whole of his history, and of his successors down to Yao, is entirely fabulous, was written after the birth of Christ, and is disbelieved by the greater part of the Chinese themselves. There is nothing known with certainty with regard to the origin of Yao, or the state of the empire before his time. There are very various calculations, also, respecting the commencement of his reign, which is placed by some in the year 2000, and by others in the year 2411 before Christ. The Shoo-king, as has been already mentioned, never specifies the year of any event; but this was afterwards fixed, according to the calculations and conjectures of the more modern annalists. They are all agreed, however, respecting the existence of Yao; and consider the chapter which relates to his reign, as having been composed in his own time, excepting the first paragraph, which contains his eulogium, and which, with many other passages in the Shoo-king, is acknowledged to be an addition of some future unknown commentator: a circumstance which greatly diminishes the authority of the book, which is the sole foundation of all their ancient history. According to this eulogium, Yao was grave, reserved, discerning, honourable, and every where renowned for the number of his good deeds. By modern authors it is related, that he was the son of the Emperor Ti-ko, a descendant of Hoang-tee; that he was born in the kingdom of Y, but afterwards removed to that of Kee, whence he is frequently named Y-kee; that, at thirteen years of age, he assisted the Emperor Tchee in the government of the empire, by whom he was placed over the country of Tao, and afterwards over that of Tang, whence he is also called Tao-tang-chee; that, at the age of fifteen, he was ten feet in height, and began to reign at sixteen; that he established his court at Ping-vang in Shansee, and ruled by the element of fire,—which is supposed to signify, that he was under the protection of the planet Mars. According to the Shoo-king, he commissioned Hi and Ho, and other astronomers, to observe the revolutions of the heavens, and to proclaim to the people the periods of the different seasons; and that, in the second year of his reign, by the assistance of these learned men, he also fixed the length of the year at 365¼ days, and 366 in every fourth year; which supposes the Chinese to have possessed a correct calendar, long before the Egyptians and Chaldeans. In the twelfth year of his reign, he visited every part of his dominions, and continued to do so once in twelve years, as long as he lived. In the 70th year of his reign, he was desirous to resign the supreme power in favour of the person who should be most capable of governing; but being satisfied neither with his own sons, nor with any of his nobles, he commanded inquiry to be made among his private subjects. A person of the name of Shun was brought before him, of whom the following history is given, which seems to have no other foundation than a wish in the author of it to recommend the virtue of filial piety. Shun was born in the year 2327, and was very much distinguished by his filial obedience. His father had another son, named Siang, by a second marriage, who was a greater favourite than himself, and who repeatedly attempted to take away his life; but, notwithstanding every provocation, he faithfully discharged the duty which he owed to his parents. At the age of twenty years, he became so renowned by his virtues, that, wherever he fixed his residence, multitudes of people settled around him; and at one place particularly, on the borders of the lake Looi-tse, he attracted such numbers, that in two years it became a town, and in the third year a city. As proofs of his filial duty, it is said, that his father, having caused him to build a granary, immediately set it on fire; and, in like manner, having ordered him to dig a well, instantly filled it up; but that Shun, nevertheless, continued to pursue the work without murmuring. It is farther related, that the emperor, having offered him his two daughters in marriage, on account of his great virtues, his father refused to give his consent, and even used means to put him to death; but that still he never permitted himself to harbour any thoughts of revenge. When he was presented to the emperor as worthy to be his successor, it was given as his recommendation, that his father was a man of a shal-

B. C. 2357.

low understanding, his step-mother a cheat, and his brother puffed up with pride; but that, nevertheless, by his obedience, he had succeeded in reforming them all. He was accepted by Yao as his successor, and received his two daughters in marriage. As soon as he entered upon his office, he employed in the service of the state eight sons of a former emperor, Tchuen-hio, who re-established order in every part of the country; and commissioned the eight sons of the Emperor Ty ko to publish the five precepts, namely, the duties of a father, of a mother, of elder sons, of younger sons, and of children. He went in person to the foot of the high mountains, without being alarmed by the fury of the winds, and thunder and rain; and under the protection of heaven and earth, and all the divinities, superior and inferior, examined every thing, and was afraid of nothing. Many troubles and calamities had prevailed during the reign of Yao, in spite of all his exertions. Inundations deluged the greater part of the country; and the remainder was almost entirely covered with forests and wild plants. Animals of every species multiplied so rapidly, that the inhabitants were afraid to show themselves. Yao was in great affliction on account of these evils, but Shun undertook to effect their removal. He appointed Yu to take charge of all that related to fire, who accordingly set fire to the forests, which covered the mountains and plains, and thus obliged the animals to go in quest of other retreats; distinguished the course of the nine rivers, and thus procured provisions; and was so incessantly employed during the eight years which he occupied in this labour, that he three times passed by his own house without stopping to enter. Keoo-tsee taught the people to sow, to plant, and to cultivate the fine fruits; but still they were in want of instruction, and Sie was commissioned to teach them the distinctions which were to be observed among them,—the duties of a father to a son, of a subject to a prince, of a wife to a husband, of a young man to an old, and of friends or equals to each other. In the 73d year of his reign, Yao, having carefully observed the conduct of Shun, proposed to declare him his successor; and though the latter at first declined the proposal, upon the ground of his not being sufficiently worthy, he was constrained to consent, and was invested with the royal authority on the first day of the first moon, in the temple of Ven-tsoo. In the year following he made the tour of his empire; arranged the seasons, months, and days; regulated music, measures, and weights; defined the five ceremonies, the vessels and instruments necessary to be employed. He made this circuit of his dominions every five years; and, during the intervening four years, the nobles came to him annually, when their conduct was examined, and rewards bestowed, or punishments inflicted, according to their merits. In the 80th year of Yao, Yu announced the termination of his labours, in drawing off the waters. He had traced and distinguished all the great mountains and rivers; cut down or burnt up the forests; and appointed the tribute which each province should pay. Here the Shoo-king gives a list of the provinces, the only instance of their being named in the ancient history of China, prior to the year before Christ 722; but a slight inspection is sufficient to satisfy any reflecting person, that the account is utterly incredible, and incompatible with the other circumstances related of the state of the empire; that it could not have been drained and cleared to so great an extent in the time mentioned, and under the direction of one individual; that many of the articles appointed to be paid as tribute, could not possibly have been produced in a country newly extricated from a marshy state; and that many of the provinces, said to have been civilized and rendered tributary, were still, according to succeeding histories, in a state of barbarism, and not even considered as subject to China, long after the year 722 before Christ. The empire, according to the Shoo-king, was at this time divided into nine districts, called Tcheoo, and afterwards into five, called Foo; of which the following account is given: Tien foo, in which was the imperial court, and which was in the centre of the other divisions, consisted of 500 lee;[*] at the distance of 100 lee, the rice was brought in with its stalk; at the distance of 200 lee, without the stalk; at the distance of 300 lee, with its husk; at the distance of 400 lee, not cleaned; and at the distance of 500 lee, cleaned. Heoo-foo consisted of 500 lee, of which the first 100 were set apart as the land of the officers of state; 200 for the magistrates, called Nan; and 300 for the greater chieftains. Sooi-foo consisted of 500 lee, of which 300 were set apart to defray the expence of teaching the sciences; and 200 for the defence of the country. Yao-foo consisted of 500 lee, of which 300 were occupied by the barbarians, and 200 by criminals. Koang-foo consisted of 500 lee, of which 300 were set apart for the barbarians named Man, and 200 for banished persons. According to succeeding historians, these divisions were disposed in a concentric form; that is to say, Tien-foo was in the centre, and the other Foo lay around it, like squares placed one within another; a division resembling that which Ezekiel made in vision of the promised land, from which the Chinese writers are supposed to have borrowed their scheme, and, of consequence, to have produced it at a period posterior to the time of that prophet. But, notwithstanding that Yu had divided the empire into nine provinces, it is recorded, that Shun, in the year following, made a new division into twelve; and though we read, that Yu had completed all that related to the waters, it is said that Shun was employed in directing canals to be dug. Mention is made, in this part of the history, of the persons who were the founders of the three first Chinese dynasties, and who are likewise all made to be descended from Hoang-tee. Yu, the head of the dynasty of Hia, was rewarded by Yao with the title of Pe, with the office of Se-kong, or superintendant of the works, with the family name of Se, and with the principality of Hia. Sie, the ancestor of the princes of the dynasty of Shang, obtained a high office, and the principality of Shang; and it is said concerning him, that his mother, when going in company with some other women to bathe, found an egg, which she swallowed, and in consequence became pregnant of Sie. Kee, the head of the Tcheoo dynasty, obtained the principality of Pin; was exposed at his birth, which his name implies; became afterwards fond of husbandry, in which he made great improvements; was placed by Yao at the head of the department of agriculture, with the title of Heoo-tsee; and was worshipped, in future times, as the deity of the husbandmen.

Early division of the empire.

The whole of this history of Yao's reign is a feeble compilation of trifling and contradictory facts, of events which took place at later periods, or which have been drawn from the history of other nations. If the inhabitants of China were, as here represented, in such a state at this period, as to require to be taught the simplest arts and first duties of life; how is it conceivable, that they had been able, many years before, to make astronomical observations, and to attain so correct a knowledge of the length of the year?

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[*] Ten lee are one league French.

Yao died in the 102d year of his reign; and the people mourned his loss three years. He is said to have left ten children, none of whom succeeded him; but one of them, named Tcheoo, was afterwards made Prince of Tang, by Yu. Shun, who had assisted Yao in the government 28 years, retired after the death of that prince to the south of the empire, where all the nobles, abandoning Tchoo the son of Yao, on account of his vices, followed to pay him homage, and to proclaim him their sovereign.

Shun, who is equally renowned in China as his predecessor, repaired, on the first day of the first moon after the death of Yao, to the hall of ancestors, gave audience to his grandees, and inquired into the state of affairs. He consulted the twelve Moo, or shepherds, and spoke to them, according to the *Shoo-king*, to this effect. "Every thing depends upon seizing the proper season for procuring the necessaries of life. Treat with kindness those who come from a distance; instruct those, who live in your vicinity; esteem and recommend those, who possess talents; place confidence only in men of worth; do not frequent the company of those, whose morals are corrupted: In this way you will succeed in reducing to obedience the barbarians of Man and of Y." He then addressed himself to his nobles, and demanded, if any among them was capable of governing, that he might place him at the head of his ministers. They unanimously presented to him Yu, who was the superintendant of the public works; and he was immediately declared prime minister, with the management of every thing relating to the land and the waters. Kee was commissioned to cause all kinds of grain to be sown in their season, in order to relieve the wants of the people; and Sie was invested with the office of instructing them in their duties, in order to preserve peace and concord. He then spoke to Kao-yao, and said, "Strangers excite disturbances. Sie, there are among the people of Hia robbers, assassins, and persons of corrupted morals; I appoint you judge, that you may administer the five rules for punishing crimes with proportionate penalties. There are three places for putting those into execution. There are districts for five degrees of banishment, and there are in these districts three kinds of dwellings."* He entrusted Tchooee with the care of the public works; and gave to Y the superintendance of the mountains, forests, lakes, ponds, plants, trees, birds, and animals; though these two departments would seem to have been included in that of Yu, who had the management of all that related to the land and the waters. Pe-y was appointed to watch over the three ceremonies, and received the office of Tchi-tsong, with these words: "From morning to evening be full of fear and reverence, and continually upon your guard to have your heart upright and free from passion." Kue-ee was appointed Master-musician, with this exhortation: "Instruct the children of the princes and nobles, so that they may be sincere, affable, complaisant, grave, and firm, without being stern or cruel. Form their understanding, that they be not proud. Explain to them your sentiments in verses, and songs, in which the words accord with the notes. If the eight tones accord, and if there be no confusion, the gods and men will be united." Then, addressing himself to Long, he said, "I detest those, whose tongue sows division, and throws every thing into disorder. I give you the office of Na-yan, that you may report to me with fidelity and sincerity all that is spoken." After which, addressing them all, he exhorted them to fulfil their respective duties. Besides these and other discourses, found in the Shoo-king, and which have every appearance of having been afterwards composed, and put into the mouths of those antient personages, with a view to convey and impress moral instruction, there are several conversations recorded as having taken place between the emperor and his ministers, of which the following may be given as a specimen. "When the great inundation," said Yu, addressing the Emperor, "rose even to the heavens, encompassed the mountains, and covered all the high places, the people were troubled, and perished in the waters; then I employed the four Tsay," (kinds of carriages,) "traversed the mountains, and cut down the woods. Along with Y I collected provisions of grain and the flesh of animals, for the subsistence of the people; and formed channels for the rivers, which I caused to flow towards the four seas. Assisted by Tsee, I caused the fields to be sown, and, by uniting the flesh of animals with that of fishes, the necessaries of life were provided. Provisions were conveyed to the places where they were wanted, and exchanges of articles were made. I then distributed the departments, and gave to them a form of government." Kao-yao bestowed great praise upon such conduct, and Yu continued, "Prince, be attentive; decide upon the object which you ought to have in view; examine the occasions on which it is necessary to deliberate, or to act; and consider how you may render the deliberation or the execution invariable. If your ministers are faithful and in concord with one another, they will attend to your decisions, and you will clearly receive the commandments of Chang-tee, who will load you with his bounties." To this discourse the emperor replied, "A minister touches (or approaches) me very near, and he who touches me very near is a minister. He is to me as a foot, a hand, an eye, an ear. He assists me to govern the people, and extends my benefits to every place." "When I wish to hear the six Lu, the five sounds, the eight tones, I examine my conduct; I wish that songs should be performed to me, accompanied by five tones. When I commit faults, I ought to be told of them; and it is highly blameable to praise me to my face, in order to censure me in my absence. When a thoughtless man utters pernicious words, let him be strictly questioned, in order to verify what he has spoken; let him afterwards be punished, and a register kept of the penalty inflicted. If he promises to amend, set his words to music, and let them be sung to him every day. If he reforms, give notice of it to the emperor; if not, punish the guilty." "How just are these words!" replied Yu. "The reputation and glory of the emperor have reached to the shores of the sea, and to the ends of the world. The wise of all countries desire to enter into his service. He knows how to reward merit. He examines all things. I have not been like Tan-tchoo, the son of Yao, vain, proud, adventurous, dissipated, cruel, and restless. In the places, where there was no water, he wished to travel by sailing; at home, he was surrounded with licentious persons, and so he succeeded not to the throne of his father. To avoid such errors, I married the daughter of the Prince of Too-shan. I remained with her four days. Afterwards, though I heard the cries of my son, I thought only of the labour, which

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* Those who consider this part of the Shoo-king as having been composed in the time of Shun, find great difficulty in explaining the words "people of Hia," as that dynasty was not then in existence, and as the Chinese were never known by that name.

History.
B. C. 2200.

I had undertaken to draw off the waters. I divided the empire into five departments, and I extended my progress as far as 5000 lee. Every province had 12 chiefs. I confined the four seas within their limits. The Miao alone could not be subdued." "It is you," replied the emperor, "who have induced my people to perform the good to which I exhorted them. Kao-yao has given great renown to your work, by establishing the five punishments; and is penetrated with esteem for your worth." Such is an example of those numerous imperial conversations and moral reflections, with which the ancient history of the Chinese abounds; and which often form the whole annals of many a reign. Their sameness, also, is so great, that it will be very unnecessary to fill our pages with frequent extracts; and the few events, which occur through the course of whole dynasties, may be compressed within a small space.

Shun, we are told, erected eminences on the twelve mountains of the twelve provinces as places of sacrifice, regulated the different kinds of music, and attended at the performance of songs and dances. One author ascribes to him the invention of a lyre with five strings, upon which Kue-ee, his chief musician, performed various airs, as a reward to the grandees, and as a mean of exciting them to a virtuous conduct. In the 32d year of his reign, it became necessary to levy troops; and a long discourse upon the subject took place between Shun, Yu, and Kao-yao, which concludes with the exaltation of Yu to be prime-minister, as Shun had been under Yao. A long history is given, by a later historian, of a law revealed from heaven to Yu, consisting of nine articles, which were represented on the back of a tortoise that came out of the river Lo. This table of numbers, called Lo-shoo, is supposed to have been borrowed from the doctrine of Pythagoras, and is considered by the Chinese as the source of all human knowledge. According to it, Yu divided the empire into nine provinces, nine mountains, nine rivers, and nine lakes, by which numbers many mysteries are understood to be expressed. In the 35th year of his reign, Shun commanded Yu to march against the Miao; but nothing is related of the effects of this armament, except that, after its return from the field, the Miao made a voluntary submission. Shun died in the year 2208 before Christ, while he was visiting the southern provinces; and the people mourned three years.

Yu, in order to avoid the sons of Shun, retired to Yang-tching, where the nobles followed and put themselves under his sway, in the year before Christ 2205. With the reign of this prince begins

The First Imperial Dynasty.

Kia.

First dynasty.

	Before Christ.		Before Christ.
Yu	2205	Tee-mang	2014
Tee-kee	2197	Tee-sie	1996
Tay-kang	2188	Tee-po-kiang	1980
Tchong-kang	2159	Tee-kiong	1921
Tay-siang	2146	Tee-kin	1900
Han-tsoo	2119	Kong-kia	1879
Shao-kang	2097	Tee-kao	1848
Tee-shoo	2057	Tee-fa	1837
Tee-hoaee	2040	Kie, or Kooei	1818

This dynasty lasted 440 years, according to some authors, and 480 according to others; and may be considered as a period of mere conjecture.

Yu is represented by the Chinese genealogists as also a descendant of Hoang-tee, but the Shoo-king makes no farther mention of him after he began to reign; and the little that is related concerning him, has been collected or conceived by later writers. Having ascended the throne, he assembled the nobles upon mount Too-shan, in the province of Kiang-nan, and explained to them the principles, by which he intended to govern. He placed in a particular situation a tambour, two different kinds of bells, and another instrument, of which the name is not known; and each of his chief officers, when they came to demand an audience, were appointed to strike upon one or other of those instruments, according to the subject of his application. According to the usage of his predecessors, he chose one of his ministers, named Y, as his successor, and having inquired into the conduct of his officers of state, set out to visit his dominions. Having met a criminal in his progress, he descended from his chariot, and burst into tears, saying, "If there are men in the empire, who do not obey the laws, the blame falls upon me. It was not thus in the time of Yao and Shun; but all the people then had only one heart." Some years after, he went into the provinces in the south, and put to death a chief of the name of Fang-fong-shee, because he was the last who appeared at the great assembly, which he had summoned; and he died after a reign of eight years.

Y, who had been nominated his successor, left the empire to Tee-kee, the son of Yu, by whom, after his death, he was honoured with animal sacrifices. This prince assembled the six generals of his army, and gave them to march against a rebel chief, who despised the laws of the empire; and some authors ascribe to him the first opening of mines and preparation of metals.

Tay-kang, according to the Shooking, was like a statue upon the throne, entirely the slave of his passions, and utterly regardless of the wishes of his people, by whom he was held in the greatest detestation; but the paintings, palaces, and extreme luxury, with the love of which this prince is reproached, are not very compatible with the recent instruction of his subjects in the art of husbandry, and in the first principles of social life.

During the reign of his brother Tchong-kang, by whom he was succeeded, took place one of the two eclipses mentioned in the Shoo-king, and fixed by succeeding annalists in the year before Christ 2159. No more of the princes of Hia are mentioned in the Shoo-king, and the remaining history of this dynasty is a miserable patch-work by later writers. Siang, the son and successor of Tchong-kang, was slain by the rebel Han-tsoo; but the widow of the dethroned prince, being left pregnant, brought forth a son named Shao-kang, who soon became distinguished by his virtues, collected the ancient subjects of his father, attacked and slew the usurper, and was reinstated on the throne of his ancestors.

In the reign of Kong-kia, it is said, that iron was taken from a mountain and formed into swords. During the same period flourished a remarkable person named Lieoo-lee, who knew how to tame serpents, and to make them obey his voice. An idle story is related of one of his serpents having died, and been given to Kong-kia to eat, who was so delighted with this new species of food, that he wished for more, to the great alarm of Lieoo-lee, who retired with his tame stock to a distant place. Kong-kia is reproached with having observed the worship of genii, and given himself up to every kind of vicious excess; and his subjects, imitating his example, the whole empire was thrown into a state of the greatest disorder and weakness.

Eating of serpents.

Kie, another wicked prince, governed the people by

History.
C. 1766.

means of a minister named Tchao-leang, who gave his sovereign the most wicked counsels. His wife Moey-kee also ruled him at her pleasure, and led him into numberless extravagances. He built magnificent palaces, the apartments of which were adorned with ivory and precious stones, in which he shut himself up, regardless of his duties as a sovereign, and abandoned himself to the grossest debaucheries. A prince of the name of Tching-tang, who ventured to remonstrate with him upon his unworthy conduct, was cast into prison; but being afterwards liberated, and joined by Tchong-koo, one of the ministers of Kie, they attacked this Chinese Sardanapalus, in his royal brothel, which he named "the palace of the night," and, having driven him from the throne, established

The Second Imperial Dynasty.

CHANG.

econd dy-
asty.

	Before Christ.		Before Christ.
Tching-tang	1766	Ho-tan kia	1534
Tay-kia	1753	Tsoo-ee	1525
Oo, or Oo-ting	1720	Tsoo-sin	1506
Tay-keng	1691	Ouo, or Oo kia	1490
Siao-kia	1666	Tsoo-ting	1465
Yong-kee	1649	Nan-keng	1433
Tay-voo	1637	Yan-kia	1408
Tchong-ting	1562	Poen-keng	1401
Ooay-gin	1549	who gave to the dynasty the name of	

YN.

Siao-sin	1373	Keng-ting	1219
Siao-ee	1352	Voo-ee	1198
Voo-ting	1324	Tay-ting	1194
Tsoo-keng	1265	Tee-ee	1191
Tsoo-kia	1258	Sheoo-sin	1154
Sin sin	1225		

Of this dynasty, the Shoo-king contains only three or four events; and the duration of the respective reigns have been conjectured by writers, posterior even to Sema tsien, who lived about a century before the birth of Christ. Its whole history is full of uncertainty, and its continuance is fixed by one historian, at 496; by another, at 600; and, by a third, at 645 years. The Shoo-king gives the same account of Tching-tang, as of the other founders of the Chinese dynasties, namely, that he persuaded his soldiers to assist him in dethroning the reigning family, by pretending to have authority from heaven to take arms. After his victory, however, he became very apprehensive, that posterity would condemn his conduct; but one of his ministers named Tchong-hoey, in a long address, which is all that the Shoo-king records of his history, succeeded in dispelling his fears. It is related of him, by other historians, that he fixed the beginning of the year at the 12th moon, which falls in winter; that he made use of chariots drawn by white horses with black heads; that he sacrificed white oxen, and formed the calendar called Kea-yu; that he afterwards visited his eastern frontiers, and charged his great men to govern the people faithfully; and that he bestowed certain districts upon the descendants of Yu, and other virtuous characters. During a season of scarcity, he shaved his head, cut his nails, and went to a high place, where he addressed his prayer to heaven in these words: "Is it because the empire is not well governed, or because my palaces are too magnificent, or because my women are too much addicted to luxury, or because I am too much inclined to listen to flatterers, that no rain is allowed to fall?" Immediately after this supplication, the clouds gathered, and rain fell in abundance. Tching-tang upon the occasion composed a piece of music, and caused an inscription to be engraved upon all the vessels of which he made use, to this effect: "Correct yourself, cease not to correct yourself."

History.
B. C. 1500.

In the first year of the reign of Tay-kia, according to the Shoo-king, the minister Ee-in offered a sacrifice to Tching-tang; presented the new king in the temple of his ancestors; pronounced the eulogium of the deceased sovereign, and gave instructions to his successor. He shewed him that, in proportion as the family of Hia followed the dictates of right reason, they were prosperous and happy, but were overwhelmed with calamities as soon as they forsook the path of virtue; that their ruin occasioned the elevation of the family of Shang, and that Tching tang, by the destruction of tyranny, and the exercise of clemency, both established his own authority and gained the love of his people. Tay-kia proving inattentive to these advices, Ee-in, in order to preserve him from the company of viscious persons, caused a palace to be built at Tong, where the tomb of Tching-tang was erected, conveyed the young prince thither, where he improved so much under his care, that at the termination of the third year of mourning, he clothed him in the royal robes, and brought him back to Po, where he addressed him again in public, and received from him, in reply, a full profession of his reformation.

Prodigy.

At the accession of Tay-voo to the throne, a remarkable prodigy is said to have taken place. A mulberry tree, and another of the name of Ko, sprung up in the palace, and grew so rapidly in the course of one day, that a man was not able to grasp them in his arms. Tay-voo, in great alarm, consulted one of his ministers, Ee-tche, who exhorted him to become virtuous; and the prince, having followed his advice, the trees immediately died. The family of Chang recovered its ancient splendour, and distant nations, to the number of sixteen, sent embassies to Tayboo, in testimony of their esteem. As a reward for his virtue, says the Shoo-king, he reigned 75 years.

Poen-keng, upon ascending the throne, proposed to remove his court to Yn; but he experienced great opposition from the people, who refused to follow him. Upon this occasion, the Shoo-king relates, that he assembled the most mutinous, reasoned them into obedience, and instructed his subjects in general in their respective duties. The whole story is worthy of notice in this view, that it furnishes a proof, from the Chinese annals themselves, that their empire, supposing it to have existed at this distant period, was of very limited extent, and more like an ambulatory tribe under their chief, than a powerful or numerous people, provided with magnificent palaces and well built cities.

Voo-ting, named also Kao-tsong, mourned for his father three years, and preserved a profound silence during all that time, leaving the care of the government to Kan-pan. But, as he persisted in his retreat and taciturnity, his nobles represented to him that a king ought to issue his orders, and apply himself to the business of the state. The prince replied in a written communication, that he kept silence from a dread of being unable to imitate the virtue of his predecessors; but that, while he was meditating upon the law, the Tee had shewn him in a dream a minister who would speak for him. A painting of this person, says the Shoo king, was made by the direction of Voo-ting, and a general search was made for the reality. After much enquiry, a person named

Yue, who followed the occupation of a mason, was found in the country of Foo-yeen in Shansee, who bore an exact resemblance to the portrait; and, having been brought to Voo-ting, was appointed his prime minister. A long discourse took place between them, in which many useful maxims and moral exhortations are expressed; but which are only a repetition of what are recorded almost in every reign.

Under the reign of Tee ee, Kee-lee, a prince of the family of Tcheoo, was appointed to the command of the army, and successively defeated the barbarians of Yen-king, of Yu-voo, and of Y-too. He received in reward of his services, a kuey or musical stone, a vessel full of wine, and the title of Keoo-pe, or prince of the empire. He was succeeded in his principality and honours by his son Tchang, or Ven-vang, who is one of the most distinguished personages among the Chinese worthies. His mother, Tai-gin, experienced no inconvenience during her pregnancy, and brought him into the world without pain. At his birth, it was predicted that he would be a great man; and his grandfather Tan foo said, at the first sight of him, "this child shall perpetuate my race." He imitated the virtues of his ancestors, respected the wise and the aged, collected learned men around his person, appointed officers for levying the revenue, put the lakes and bridges into a state of good repair, repressed the power and boldness of the vicious, established order every where, and provided for the support of widows, orphans, and old men. Ven-vang married a virtuous princess, named Tay-su, by whom he had ten children, the youngest of whom named Fa, the same who was afterwards called Voo-vang, gave early indications of greatness, and was appointed by Ven-vang to be his successor. By the command of Tee ee, Ven-vang marched to the western frontiers, and subdued the barbarous people Kuon-ee; and afterwards to the north, where he was equally successful against the Tartars of Kien yun.

Sin, or Sheoo, the son and successor of Tee-ee, was a worthless prince, crafty, vain, profuse, and much addicted to wine and women. He was so strong and courageous, that he was able to subdue the most ferocious animals; and is considered as the inventor of the little ivory sticks, which the Chinese employ in eating their food. He married a princess, named Tan-kee, to whose will he became entirely subservient, and employed himself wholly in music, dancing, and amassing wealth. He kept a multitude of dogs, horses, and wild beasts enclosed in parks; despised the gods, and thought of nothing but his pleasures. He filled a pond with wine, collected delicacies of every description, and assembled around him the most licentious persons of both sexes. He contrived a new mode of punishment, according to which the sufferer was compelled to walk upon a large bar of red hot iron, which was so placed, that upon falling from it he was received into a fire of live coals, an exhibition which occasioned much merriment to Tan-kee. Ven-vang, Kieoo-hieoo, and Oo-heoo, were at this time the three principal men of the empire. The second had a daughter whom he gave to Sin; but upon her refusing to take part in his debaucheries, he caused her to be cut in pieces, and presented as food to her father. Oo-heoo having remonstrated with the emperor upon such barbarity, he was put to a similar death. Ven-vang lamented these events in silence, of which the king being informed, threw him into prison, lest he should cause an insurrection among the people, who began to be extremely discontented. Ven-vang, during his confinement, applied himself to the study of Y-king, a work ascribed to Fo-hee, and which shall afterwards be described. The people of his principality, however, who regarded him as their parent, continuing to petition for his liberty, and the neighbouring barbarians beginning to make incursions into the empire, Sin at length brought him out of prison, and put him at the head of the army. Ven-vang prevailed upon the emperor, by presenting him with the country called Lo, to abolish the punishment of the iron pillar; and was declared, in return for his services, chief of all the western vassals. But Sin was surrounded by wicked ministers, who attempted to calumniate the conduct of Ven-vang, and to accomplish his destruction. Their machinations excited the great vassals of the empire to revolt in support of Ven-vang; but, instead of putting himself at their head, he persuaded them to return to their duty. The virtues of Ven vang rendered his name so celebrated, that neighbouring princes applied to him as umpire in their contentions; and it is related, that, when those of Yu and of Tooy, were on their way to his residence for this purpose, they were so impressed with the flourishing and orderly state of his territories, that they were ashamed of their own folly, voluntarily abandoned their disputes, and returned to imitate this excellent prince. Forty kingdoms are said to have submitted voluntarily to the sway of Ven-vang; but, in the Chinese annals, even long posterior to this era, a village was called a kingdom. In proof of his good government, and of the superior civilization of his subjects, it is related, that, in his dominions, the lands were carefully divided, and each family provided with a sufficient quantity of ground for their support; that the habitations were surrounded with mulberry trees, and the women employed in rearing silk worms; that there were in every house five hens and two swine, to supply proper food for the old men; that the people had been instructed to plant trees, and rear domestic animals; that the peasants were seen every where peaceably employed in their labours, and the travellers pursuing their journey in safety. But, if all these marks of improvement were now seen for the first time in Shensee, which had been first inhabited, and were peculiar to the principality of Ven-vang; what becomes of the great empire of China, which, according to its historians, had already subsisted 1800 years in a state of grandeur and civilization? But, to return to Ven-vang, who, after all those great actions, is called by one of the historians who celebrate his praise, a barbarian of the West, he continued to subdue the savage people of Mee-sin, of Kee, of Yu, and of Tsong, all dwelling within the limits of the province of Shen-see, and died soon after in the 96th year of his age. He was succeeded by his son Fa or Voo-vang, who immediately reviewed his troops and set out to subjugate the country of Lee towards the east. Sin, in the mean time, continued to despise all the advisers of his friends, and to punish every one, who ventured to remonstrate with him upon his conduct. To one of these unhappy persons he said, upon sentencing him to death, that he had heard, that wise men had seven holes in their heart, and that he would take out his to ascertain the point. This was his last act of cruelty. Voo-vang, at the head of 800 vassal chiefs, marched against the monster, deprived him of the empire, and founded

New punishment.

Cruelties of the emperor.

B. C. 1120.

The Third Imperial Dynasty.

TCHEOO.

Third dynasty.

	Before Christ.		Before Christ.
Voo-vang	1122	Siang-vang	651
Tching-vang	1115	King-vang	618
Kang-vang	1098	Kuang-vang	612
Tchao-vang	1052	Ting-vang	606
Moo-vang	1001	Kien-vang	585
Kong-vang	946	Ling-vang	571
Y-vang	934	King-vang	544
Hiao-vang	909	King-vang	519
Y-vang	894	Yuen-vang	475
Lee-vang	878	Tching-ting-vang	468
Siuen-vang	827	Kao-vang	440
Yeoo-vang	781	Goey-lie-vang	425
Ping-vang	770	Ngan-vang	401
Huon-vang	719	Lie-vang	375
Tchoang-vang	696	Hien-vang	368
Hee-vang	681	Tchin-tsin-vang	320
Hoey-vang	676	Nan-vang	314

The history and chronology of this dynasty are not less involved in uncertainty, than those of the two preceding. The Shoo-king affords no data for fixing the period of its commencement; and even the historian Se-ma-tsien does not venture to assign any dates, till the year 841 before Christ. The whole account of the expedition of Voo-vang, according to the Shoo-king, exclusive of his harangues to his followers, is comprised in this, that as soon as he had begun the attack upon the army of Sin, the royal forces fled in such terror that they destroyed one another; that he restored the empire of Chang to its former state, set at liberty those whom the emperor had imprisoned, distributed among the people the wealth which the tyrant had amassed in his tower of Loo-tay, returned to his own court at Fong in Shansee, and disbanded the whole of his army. Other historians have added, or rather invented, the following particulars: That the army of Sin consisted of 700,000 men, who dispersed upon the first appearance of Voo-vang; that Sin then shut himself up in his tower of Loo-tay, to which he set fire, and perished in the midst of his treasures; that Voo-vang put to death the cruel queen Tan-kee, and entered the imperial residence, at the head of his generals, amidst the acclamations of the people whom he had delivered. Voo-vang restored the kingdom of Shang to Voo-keng; but, according to others, he bestowed it upon his own brother Kang-sho, to whom he addressed a long discourse on morals and government, which is recorded at length in the Shoo-king. He divided his dominions into numerous principalities, which he conferred upon the most distinguished chiefs, who are all made out to have been the descendants of Hoang-tee, of Yao, of Shun, of Yu, of the races of Hia and Shang. Having offered sacrifices to his ancestors, and appointed various political regulations, he gave his attention entirely to the study of philosophy, and placed himself under the tuition of Kee-tse, elder brother of the late Emperor Sin, with whose instructions, entitled, "The Sublime Rule," a whole chapter of the Shoo-king is filled. As a reward for his services, this philosopher received the kingdom of Corea, which he is said to have brought from the rudest barbarism into a state of the highest civilization, though the same people are described, ages afterwards, as still in a savage condition.

B. C. 1000.

As Tching-vang, the son of Voo-vang, was only thirteen years of age at the death of his father, his uncle Tcheoo-kong took charge of the government of the empire, and the education of the young prince. The worthy regent, however, having been charged by his enemies with entertaining designs against the life of the young king, thought it prudent to withdraw from court; and, by the machinations of the same persons, who were also uncles of the prince, Voo-keng, son of Sin, who had been allowed by Voo-vang to rule over the country of Yn, was excited to take advantage of the youth of Tching-vang, and to raise the standard of rebellion. The innocence of Tcheoo-keng, however, having been miraculously proved, he resumed his functions, and, together with Tching-vang, subdued Voo-keng, and various neighbouring tribes. The history of the first eleven years of this reign, abounds in political measures and geographical descriptions, which are utterly irreconcileable and unintelligible. The young prince is represented, at one time, as addressing sage discourses to his assembled grandees; and, at another, as receiving instructions from his guardian Tcheoo-kong. The Kia, the Shang, or the Yn, are repeatedly spoken of, not as the descendants of the dethroned dynasties, but as distinct nations, occasionally rebelling, not against the reigning family, as might be supposed from the history, but against the nation of the Tcheoo. Tching-vang is related to have found it necessary, for the peace of his dominions, to remove his imperial residence to a new city, which he built on the banks of the river Lo in five days; and immediately to have left this new habitation under the government of Tcheoo-kong, and returned to his former abode at Fong in Shen-see. From the eleventh to the thirty-seventh year of the reign of Tching-vang, nothing is recorded concerning him, except that, feeling his end approaching, he called for water to wash his face and hands, put on his royal vestments, assembled his nobles, and recommended to them his son Tchao-kong as his successor; of whose coronation a long and minute description is given by the Chinese annalists. This prince is known in history by the name of Kang-vang, *i. e.* "peaceful prince;" but nothing is recorded concerning him till the 12th year of his reign, when he is described as recommending the country of Lo to the care of his prime minister, while he should be absent at Fong. In the course of this address, he speaks of the small number of his people the Tcheoo; and of the care, which was necessary to preserve their authority over the people of Yn, who, of consequence, could not be much more numerous; and who, when both united under one chief, could not form that vast and powerful empire which China is represented and supposed to have been during ages. Prior to this date, nothing more is said of Kang-vang, but that he honoured the gods, and preserved peace in his dominions; that the prisons were empty, and that for forty years no punishments had been inflicted; that, in a word, the times of Yao and Shun were restored during his reign. Of the two succeeding emperors, Tchao-vang and Moo-vang, nothing is recorded in the Shoo-king, except a discourse by the latter addressed to one of his viceroys, and an official sketch of the criminal code of the empire. But other historians relate of Moo-vang, that, in the 17th year of his reign, he made war upon the barbarous people named Joug, and afterwards went to visit a princess, called "the Mother of the King of the West." On the western frontiers, also, of his empire lived a very extraordinary man, who possessed the secret of transforming himself

Chinese magician.

into different shapes, of separating mountains, and of transporting cities from one place to another. With this person the king resided ten years, without troubling himself about his kingdom; and, during that time, was entertained by the magician with admirable music, and conveyed from place to place in enchanted chariots. While he was amusing himself in this manner, his subjects became discontented, and rose in rebellion; but Moo-vang, returning promptly to his court, subdued the insurgents, and afterwards marched against the barbarians of Kuen-jong, whose country is described as situated at the extremity of the empire, but, nevertheless, as not far from the capital in the province of Shen-see.

In the eighth year of the reign of Y-vang, mention is made of a chief named Hiong-kiu, prince of the barbarians of Tsoo, who subdued the other barbarians in his neighbourhood, and made his sons rulers over all the nations to the north of Kiang; and, as this chief denied that he was a Chinese, though numbered by historians among the descendants of Hoang-tee, it follows, from the account of his conquests, that neither Hoo-quang, nor Kiang-nan, nor any of the provinces farther south, were at this time, (888 years before Christ,) or had ever been, under the dominion of the Chinese, which reduces its extent more than one-half of what it is described to have been in the earliest ages.

In the 30th year of the reign of Lee-vang, whose name signifies "cruel prince," it is recorded that there happened a great drought; that the barbarians of Tsoo made inroads upon the empire on the south, the Tartars on the north, and the people of Hoay on the east; that the prince of Kuo, who was sent against them, returned with little success; and that all these calamities, united with the cruelty of the emperor, rendered the people extremely discontented. The barbarians of Jong advanced into Shen-see, and were joined by the disaffected chiefs in such numbers, that Lee-vang was obliged to seek safety by flight; and, (which proves that his dominions were not very extensive,) had only to cross the river Hoang-ho, to be out of his kingdom, and to find himself secure in Shan-see. It was chiefly in this reign, that the independence of some vassal princes, especially those of Tsin, of Tsee, and Oey, was established; and that a kind of confederation was formed among them, at the head of which, as both sovereign and pontiff, was the prince of Sigan-foo in Shan-see. Many other princes begin to be mentioned at this period of the history, whose states were comprised chiefly in the provinces of Shen-see, Shan-see, Pe-tche-lee, Honan, and Shang-tong. All these principalities, which afterwards formed the Chinese empire, were of very small extent; and several of them comprehended only the territory of a city of the first order, situated in the midst of the native barbarians.

Chinese history assumes a more authentic appearance.

It is in the reign of Siuen-vang, that Se-ma-tsien, the first historian of China, and who lived about a century before Christ, begins to affix dates to his narrative; and from this period, therefore, the Chinese history begins to have at least the semblance of greater certainty. It is recorded of this prince, that he resolved to take the number of his subjects, in opposition to the advice of his ministers, who represented to him, but without effect, that the officer, who presided over that department, knew the number of families, of births, and of deaths; but that, by openly making a survey of the people, the more powerful vassals might become acquainted with the state of the empire, and encouraged to excite commotions.

During the reign of Yeoo-vang, an account of the empire is given, as it existed in the year before Christ 774, which proves, that it was still comprehended in the provinces of Shen-see, Shan-see, Pe-tche-lee, Honan, and Shang-tong, great part of which was occupied by barbarians; that it was surrounded by the barbarians of Jong and King on the south; by the states of Oey, Yen, and the barbarians of Tie and Sien-yu on the north; by the states of Yu, Kuo, Tsin, Ho, Yang, Goey, and Shooy on the east; by those of Tsee, Loo, Tsao, Song, Tong, Sie, Tseoo, and Kiu on the east. These different states, which were held by the descendants or allies of the reigning dynasty, were so limited and unsettled, that it was no uncommon event for a prince and the whole of his subjects to transport themselves from one territory to another. Yeoo-vang, by his foolish conduct, increased the troubles and dangers to which the empire was exposed. Perceiving that Pao-se, a young woman, to whom he had completely attached himself, was not much disposed to laugh, he used all the means in his power to excite her risible faculties, but without effect, till he thought of causing fires to be kindled, and drums to be sounded, as if an enemy had appeared; and as the vassal princes, who hastened to his assistance, expressed their astonishment, Pao-se laughed excessively at their disappointment, which pleased the emperor so much, that he repeated the same trick so often, that at length, when he was in reality attacked by the prince of Shin, his signals were disregarded by his chiefs, he himself was slain, and Pao-se, with all his treasures, fell into the hands of the enemy. This trifling story of an imperial hoax is deserving of notice, only as an additional proof of the limited extent of the Chinese empire, when the lighting of fires and beating of drums was sufficient to collect the surrounding vassals.

Fatal hoax by a Chinese prince.

During the reign of Ping-vang, also, mention is made of a prince of Tsin, who was admitted into the number of the chief vassals, upon the ground of his keeping the barbarous tribes in awe; but who is himself described, in some of the Chinese books, as a complete barbarian, whose subjects were still utterly savage in their manners, though they had resided more than 100 years in the province of Shen-see, in the heart of which the Chinese emperors had ruled by this time nearly 400 years. A circumstance, which sufficiently demonstrates, that, even according to the accounts of the Chinese historians, sciences, morals, and good government, had not made so great progress in China in ancient times, as they themselves pretend. Towards the end of the reign of Ping-vang, the princes of Loo began to exercise certain privileges, which belonged to the emperor alone; and the history of this period is filled chiefly with details of the contests which the different vassal princes carried on with one another. It is from the end of this reign, about the year 722 before Christ, that Confucius commenced his history, called Tchun-tsieoo, or History of the Prince of Loo, which was his native country; and that the Chinese annals assume a more authentic appearance. But, from the view, which has been given of the preceding ages, which may be considered as the ancient and fabulous period of Chinese history, it is evident, that of the 15 provinces of the empire, ten were hitherto occupied solely by barbarians; that of the other five, a great portion was still possessed by equally savage tribes; that there were in the midst of these a few towns or villages, with some cultivated spots around them, which were called kingdoms; and that the Chinese nation, instead of having been at this period a numerous, rich, and powerful people, consisted of a few wandering tribes, moving their habitations from place to place, as circumstances required. The remaining history of the dynasty

Commencement of the history by Confucius.

State of the Chinese empire at this period.

of Tcheoo is occupied almost entirely with an account of the wars among the tributary princes; and is called by the Chinese, "the years of war," or "the warlike ages." Several of these vassal chiefs became so powerful by the conquest of their neighbours, that they soon began to disregard the authority of the emperors, who, during a space of 400 years, had more the name than the power of a sovereign. During this turbulent period, many kingdoms arose and disappeared, of which the most powerful towards the conclusion of the dynasty were Tsoo, governed by Kao-lie-vang; Yen, by Hiao-vang; Oey, by Ngang-lee-vang; Tchao, by Hcao-tching-vang; Han, by Huon-hoey; Tsee, by Vang-kin; and Tsin, by Tchao-siang-vang. This last mentioned prince had assumed, in the year before Christ 288, the title of Emperor of the West; and, in 255, dethroned, without a struggle, the Emperor Nan-vang, who had never possessed either dominions or authority. This introduced,

The Fourth Imperial Dynasty.

TSIN.

Fourth dynasty.

	Before Christ.		Before Christ.
Tchao siang-vang	*255*	Shee-hoang-tee	246
Hiao-ven-vang	250	Eul-shee-hoang-tee	209
Tchoang-siang-vang	249		

The most celebrated prince of this dynasty was Shee-hoang-tee, named also Tching, who subdued the numerous kingdoms which had risen upon the ruins of the imperial dominions, and completely re-established the ancient power of the empire. He greatly extended its boundaries by new conquests, especially in the province of Quang-tong, and the adjoining districts, which had never been subjugated; and transported 500,000 men to occupy and preserve his new territories. He gained possession also of the country of Ortoo, constructed 44 cities along the river Hoang-ho, united the different portions of wall. which had been raised by the princes of Tchao and Yen, against the invading Tartars; and thus completed at length the great wall, after having sent an army of 100,000 men against the Hiong-noo, or Huns, whom he drove to a great distance from his frontiers. In the 34th year of his reign, 213 before Christ, he commanded all the books and writings in the empire to be burned, except those which treated of medicine, divination, and agriculture; a measure, which he conceived to be necessary, in order to abolish the multitude of synonymous characters which had been introduced into the language, and to compel the literati to adopt a more uniform mode of writing (see p. 218.); or, according to others, as a most effectual mean of obliterating the renown of his predecessors, and of securing the first place to his own name in the annals of the empire. In the 32d year of his reign, it is related, that a star fell to the earth, which immediately became a stone; and that some persons caused these words to be engraved upon it: "Shee-hoang-tee is drawing near his end, and his empire shall be divided;" but the emperor immediately commanded the stone to be broken in pieces, and all the inhabitants in the neighbourhood of the place, where it was found, to be put to death. Having, at length, after numerous wars, settled his dominions in a profound peace, his ministers advised him to erect new principalities for the establishment of his younger sons; but he reminded them of the troubles, which had been excited under former dynasties, by the contentions and ambition of the dependent princes; and resolved rather to build palaces in different cities, for the inferior branches of the imperial family, where they should be maintained at the expence of the emperor, according to their rank, without possessing any authority over the people; a regulation which has continued to be observed in China from that period to the present time. Under the reign of his successor, whose cruelty, licentiousness, and impolitic measures had excited a general insurrection throughout the empire, appeared the famous Lieoo-pang, who was successively a private soldier, a captain of a troop of robbers, a general, a petty prince, and, at length, usurper of the throne, and founder of

Destruction of Chinese writings.

The Fifth Imperial Dynasty.

HAN.

Fifth dynasty.

	Before Christ.		After Christ.
Lieoo-pang, or Kao-tee	202	Vang-mang	9
Hoey-tee	194	Tee-yuen	23
Kao heco, wife of Kao-tee	187	Kuang-voo-tee	25
Ven-tee	179	Ming-tee	58
King-tee	156	Tchang-tee	76
Voo-tee	140	Ho-tee	89
Tchao-tee	86	Shang-tee	106
Siuen-tee	73	Ngan-tee	107
Yuen-tee	48	Pe-king-heoo	125
Tching-tee	32	Shun-tee	126
Ngay-tee	6	Tchong-tee	145
		Tche-tee	146
		Huon-tee	147
	After Christ.	Ling-tee	168
Ping-tee	1	Shao-tee	189
In-tse-ing-kin-nie	6	Hien-tee	190

The most celebrated sovereigns of this dynasty were, Ven-tee, a wise and virtuous prince, who greatly exalted the imperial dignity, and increased the wealth of the empire. He was remarkable at once for his frugality and generosity. He forbade the employment of gold and silver in the utensils of his palace, and the use of silk in the dress of his women; and by his economical style of living, he was able to remit one half of the ordinary taxes, and to maintain all the aged poor in his dominions at his own expence. He was careful to encourage agriculture by his patronage and example. He was also a great lover of learning; and promoted the search after the remnants of the ancient writings, which had been destroyed. He enlarged the boundaries of the empire towards the south; and repulsed the Tartar tribes, who had taken advantage of the troubles preceding his reign, to make incursions into the Chinese territories.

Voo-tee was a prince of excellent qualities, but naturally inclined to war. He yielded, however, to the advice of the wise men whom he consulted, and who all united in preferring a state of peace to the most just and successful military enterprises. He promoted the republication of those books, which had escaped the general ruin, and caused the morals of Confucius to be taught in the schools. His martial spirit having been roused by the inroads of the Tartars, he drove them beyond the great wall with signal success; and is said to have pushed his conquests over to Siam and Bengal. But both these princes, with all their wisdom and talents, were much addicted to the tenets of the Tao-tse, or immortals, who pretended to prepare a liquor, which rendered man exempt from death. The grandees of Voo-tee were grieved with the infatuation of the emperor on this subject, and presented frequent remonstrances without effect. One of them, happening one day to be in the Emperor's presence, when the mysterious beverage was brought to him, suddenly seized the cup and swallowed its contents. The mo-

Practical argument against the superstition of the emperor.

narch, enraged at such presumption, gave instant orders that he should be put to death. "Your command is of no avail," said the courtier, without emotion; "if this liquor hath rendered me immortal, you have no power to deprive me of life; and, if it has left me still subject to death, you rather owe me a recompense for having exposed the imposture." This answer saved the life of the minister, but did not cure the monarch of his credulity.

Exemplary empress.

Ming-tee, famed for his clemency and wisdom, made choice of a lady as his empress, who was a pattern of modesty and discretion, and who never made use of embroidered dresses; established an academy in his palace for the instruction of the young princes and nobles, and took great pleasure in being present at their exercises; raised one of those immense banks, which inclose the river Hoang-ho, and which he extended to a length of ten leagues. It was this prince, who, remembering in a dream a saying of Confucius, that the "Holy One was to be found in the west," sent ambassadors in search of that person and his doctrine, who, instead of Christianity, which is conceived to have better answered the interpretation of the words and dream, brought back the worship of the god Fo.

Increasing influence of the eunuchs.

In the course of this dynasty, especially under the reign of Voo-tee, the Chinese, after long wars and varying success, extended their empire both to the west and south; and drove the Huns and Tartars to a due distance from their frontiers on the north. But, towards the conclusion of the dynasty, particularly during the three last reigns, eunuchs began to multiply at court, and to acquire political influence with the emperors, which was the cause of exciting perpetual contentions in the government, and of encouraging the ambitious attempts of the petty princes. The empire was at length thrown into the utmost confusion during the reign of Hien-tee, a young and indolent prince; and in the year after Christ 220, was divided into three separate kingdoms, under as many independent sovereigns. Of those three reigning families, the Sho-han, Oey, and Ou, the first, which signifies the remnant of the Han, is considered as

The Sixth Dynasty.

Sixth dynasty.

Sho-han.		Oey.		Ou.	
Tchao-lie-tee	221	Ven-tee	220	Ta-tee	222
Heoo-tcheoo	223	Ming-tee	227	Hoey-kee-vang	252
		Ty-fang	240	King-tee . . :	258
		Ty-mao	254	Oo-tchin-heoo	264
		Yuen-tee	260		

The whole period of this short dynasty was a season of warlike commotion. The dominions of Heoo-tchoo enjoyed the greatest share of repose, through the exertions of two famous generals in his service, one of whom, named Quang-yoo, is worshipped as the Chinese Mars. Heoo-tchoo, however, who is reproached with being not so much a peaceable, as a cowardly prince, was attacked by one of his rebellious generals, Song-tchao, to whom he quietly surrendered the throne, and was contented to receive a small principality for his subsistence.

Chinese Mars.

The Seventh Imperial Dynasty.

*Tsin.

Seventh dynasty.

Voo-tee	265	Kang-tee	343
Hoey-tee	290	Moo-tee	345
Hoay-tee	307	Ngay-tee	362
Min-tee	313	Tee-ee	366
Yuen-tee	317	Kien-ven tee	371
Ming-tee	323	Hiao-voo-tee	373
Tching-tee	326	Ngan-tee	397
Kong-tee	419		

During the whole period also of this dynasty, a constant succession of wars and struggles for the empire prevailed; and excepting Voo-tee, who kept the petty princes in awe, few of the other sovereigns died a natural death, or without being first dethroned. In the course of this period, the northern armies began to evince their superiority over the more southern, both by their own native courage, and also by the assistance which they frequently derived from the Tartar tribes. Hence originated the division of China, during the four following dynasties, into

Division of the empire into northern and southern.

The Southern Empire, . . and . . The Northern Empire.

Eighth dynasty.

Eighth Imperial Dynasty. Song.		Yuen-Oey, or First Oey. *Tartars of Topa.*	
Voo-tee	420	Tao-voo-tee	386
Yng-yang-vang	423	Ming-yuen-tee	409
Ven-tee	424	Tay-voo-tee	424
Hiao-voo-tee	454	Ven-tching-tee : . . .	453
Ming-tee	465	Hien-ven-tee	466
Tchoo-yo	473		
Shun-tee	477		

Voo-tee, the founder of this dynasty, whose first name was Lieoo-hoo, was of the lowest origin, and used to traverse the country selling shoes; but, at length, becoming a soldier, he attained to the command of a great army, and murdered the two last emperors of the former family. He fixed his court at Nan-kin, his native place; and is said to have possessed a figure and deportment inexpressibly noble and majestic. Long and bloody wars were carried on between the northern and southern empires, during the reign of Ven-tee and his rival Tay-voo-tee. The remaining sovereigns of this dynasty were noted for their horrid cruelties; and the two last mentioned were murdered by the prime minister, Siao-tao-tching, who afterwards took the name of Kao-tee, and became the founder of

The Ninth Imperial Dynasty.

Ninth dynasty.

Tsee.		*Northern Empire.*	
Kao-tee	479	Hiao-ven-tee	471
Voo-tee	483	Siuen-voo-tee	500
Ming-tee	494	Hiao-ming-tee	516
Tchoo-pao-kiuen . . .	499	Hiao-tchoang-tee . .	528
Ho-tee	501	Tsie-min-tee	531
		Hiao-voo-tee	532

During this dynasty, and in the reign of Voo-tee, appeared the atheistical philosopher Fan-shin, whose doctrine is said to be still privately entertained by many of the Chinese literati, and whose system was simply this, that all the events in the world are the result of chance, and that the soul dies with the body. About the same time, the prime minister Siao-yieuen, rose to distinction; a man of boundless ambition, who afterwards murdered the two last monarchs of the present race, and founded

Atheistical philosophy.

Tenth dynasty.

The Tenth Imperial Dynasty. Leang.		*Eastern Oey.* Tong-Oey.		*Western Oey.* Sy-Oey.	
Voo-tee . .	502	Hiao-tsing-tee	534	Ven-tee . .	535
Kien-ven-tee	550			Fee-tee . . .	552
Yuen-tee . .	552			Kong tee . .	554
King-tee . .	555				

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* This appellation is written and accented in the Chinese language, so as to sound differently from the name of the fourth dynasty.

History.
A. D. 550.

The founder of this dynasty, who assumed the name of Voo-tee, was the most able of all its sovereigns; but became at length so fond of the Bonzes, that he resolved to become one of their order. The grandees of the empire in a manner forced him to resume the government, but he still continued to live after the manner of the Bonzes. Towards the latter end of his reign, he was seized and starved to death by the king of Ho-nan, one of his tributary vassals. During the existence of this dynasty in the south, the northern empire was divided into two kingdoms, the eastern and western, which were both much distracted between the patrons and the opponents of the Bonzes. Again it is recorded, that a prime-minister Shin-pa-sien, murdered the two last sovereigns of the reigning family; and, adopting also the name of Voo-tee, like the preceding usurpers, became the founder of

Eleventh dynasty.

The Eleventh Imperial Dynasty.	*Eastern.*	*Western.*
TCHIN.	PE-TSEE.	HEOO-TCHEOO.
Voo-tee . . 557	Ven-siuen-tee 550	Min-tee . . 557
Ven-tee . . 560	Hiao-tchao-tee 560	Ming-tee . 558
Tchoo-pe-tsong . . 567	Voo-tching-tee 561	Voo-tee . 562
Siuen-tee . 569	Heoo-tchoo . 565	Siuen-tee . . 580
Heoo-tchoo 583	Yeoo-tchoo . 577	Tsing-tee . 581

The princes of this dynasty are in general celebrated as wise and virtuous monarchs, friendly to learning, and attentive to the welfare of their subjects. It was in the reign of Ven-tee, that the night-watches were first intimated by the beating of a drum; a method which has continued to be observed in China ever since his time. The last named sovereign of this family having abandoned himself to a licentious life, was dethroned by Yang-kien, who afterwards assumed the name of Ven-tee, and founded

The Twelfth Imperial Dynasty.

SOOY.

Twelfth dynasty.

Ven-tee	581	Kong-tee	618
Yang-tee	605		

Union of northern and southern empires.

Ven-tee, seven years after his usurpation, reunited the northern and southern empires, which had continued distinct nearly 300 years, and of which the river Yang-tse-kiang had been the constant boundary. He was a prince of solid understanding, and the greatest temperance and moderation. He was strictly vigilant over the conduct of the administrators of justice; and made a regulation, which excluded merchants and mechanics from offices of state. He restrained the progress of licentious music, and other enervating amusements; and caused a portion of rice and other grain to be levied as part of the revenue, and to be preserved as a resource in seasons of scarcity. His son and successor Yang-tee, though he made his way to the throne by the murder both of his father and elder brother, and though much addicted to every species of luxury, yet made many useful regulations; repaired the great wall, which had fallen into decay, encouraged the progress of literature, and was the first who prohibited all his subjects, except the military, from wearing arms about their person. His successor was dethroned by Li-yien, one of the petty princes of the empire, who afterwards was called Kao-tsoo, and founded

The Thirteenth Imperial Dynasty.

TANG.

History.
A. D. 600.
Thirteenth dynasty.

Kao-tsoo	618	Shun-tsong	805
Tay-tsong	626	Hien-tsong	806
Kao-tsong	650	Moo-tsong	821
Tchong-tchong	684	King-tsong	825
Voo-shee	684	Ven-tsong	827
Tchong-tsong	705	Voo-tsong	841
Jooy-tsong	710	Siuen-tsong	847
Hiuen-vong	713	Y-tsong	860
Soo-tsong	756	Hee-tsong	874
Tay-tsong	763	Tchao-tsong	889
Te-tsong	780	Tchao-siuen-tee	905

Excellent emperor and empress.

Tay-tsong, the second prince of this dynasty, was one of the most renowned and virtuous of the Chinese monarchs. He was a great lover of learning, and is said to have instituted an academy in his own palace, at which 8000 scholars were instructed in all kinds of literature. He was a determined enemy to every species of bribery, especially in the administration of justice; and held all descriptions of diviners in the utmost contempt. It was in his reign, that certain Nestorian Christians entered China (of whom a more particular account will afterwards be given), and were not only permitted to preach their tenets, but received from the emperor a piece of ground in the capital, for building a place of worship. His empress was equally celebrated for her excellent qualities; and was the author of a book upon the due behaviour of women *in their inner apartments*. After her death, he admitted into his palace a young lady of singular beauty and talents, about fourteen years of age, named Voo-shee, who, after his decease, retired into a monastery of bonzesses, from which she was taken by his son and successor, Kao-tsong, and invested with the disposal of every thing in the empire. She proved a monster of ambition and cruelty, while she received from the infatuated emperor the title of "Queen of Heaven." She had been at first admitted into the palace as a concubine, and had experienced great favour from the empress. She soon, however, found means to have her benefactress divorced, on account of sterility; and, upon discovering, that the emperor still retained some affection for his discarded queen, caused her to be cruelly put to death. She sacrificed, in like manner, numbers of the royal family, who incurred her displeasure, or appeared to stand in the way of her plans. She was no less merciless to her own children; poisoned her eldest son, and banished the second, that she might raise the younger brother to the throne, whom she could more easily render subservient to her will. After the death of the emperor, she openly assumed, what she had long privately exercised, the absolute direction of affairs, and ruled the empire with the greatest ability, but with the most savage tyranny; cut off, without remorse, those nobles whom she suspected to be unfriendly to her interest; quelled insurrections, and detected conspiracies by her vigilance and resolution; kept her subjects in awe and submission, by the terrible vengeance, which she inflicted upon the disaffected and seditious; and supported herself firmly upon the throne, for the space of twenty-two years. At length, some of the boldest of the nobles, headed by one of her sons, burst into the palace; cut in pieces her attendants and confidants; and, while they trembled in her presence, intimated that her reign was at an end. She then calmly led her son to the throne, and retired to the

An ambitious and cruel princess.

apartments of the women, where she did not survive her deposition many months. Under the succeeding sovereigns of this dynasty, the empire was frequently thrown into the greatest confusion by the incursions of the Tartars, and the struggles of the tributary princes. The influence of the eunuchs, also, increased to such a degree, that, like the pretorian bands of Rome, they frequently disposed of the empire at their pleasure. In the reign of Tchao-tsong, a wise and valiant prince, their insolence became so intolerable, that the emperor entered into a plan with his counsellors to abolish their power for ever; but the eunuchs, having been apprised of the designs forming against their interests, came suddenly upon their sovereign with a band of soldiers, and hurried him into a remote apartment of the palace, where he was left under a strong guard, with only a hole in the wall for the conveyance of his food. By the courage of his prime minister, however, he was rescued from the hands of the rebels; and, having invited to his assistance a captain of banditti, named Shoo-ven, issued an order for extirpating the whole class of eunuchs, except thirty of the youngest, to be reserved for the most servile offices of the palace. His commission was faithfully executed by Shoo-ven; and many hundreds of them were put to the sword. The executioner, however, as if inspired with the ambitious spirit of those whom he had slain, murdered first the faithful prime minister, and afterwards the emperor himself; but permitted his son Tchao-siuen-tsong to reign for two years, when he assumed the sovereignty, and, under the name of Tay-tsoo, founded

Influence of eunuchs.

Massacre of eunuchs.

The Fourteenth Imperial Dynasty.		*Tartars.*	
Heoo-leang.		Keetan, or Leao.	
Tay-tsoo	907	Tay-tsoo	907
Mo-tee	913	Tay-tsong	927

Fourteenth dynasty.

During this, and the four following petty dynasties, a warlike Tartar nation, who inhabited the country, now called Leao-tong, established a powerful empire in the northern part of China, and proved very formidable neighbours to the Chinese princes. Mo-tee was dethroned by Tchoang-tseng, the son of the celebrated one-eyed general Li-ke-yong, who had received the principality of Tsin, on account of his eminent services in the reign of Hee-tsong; and by him was founded

Increase of the Tartar power.

The Fifteenth Imperial Dynasty.		*Tartars.*
Heoo-tang.		
Tchoang-tsong	923	
Ming-tsong	926	Tay-tsong, continued.
Min-tee	934	Tay-tsong, continued.
Loo-tee	934	

Fifteenth dynasty.

Ming-tsong, though originally a foreigner, and only adopted into the Imperial family, was a truly excellent and pious prince; and was the author of a useful regulation, which excluded all eunuchs from public employments. His son in law, She-king-tang, by the assistance of the Tartars of Leao-tong, deprived Min-tee of his crown and life; dethroned his successor Loo-tee, and, under the name of Kao-tsoo, founded

Exclusion of eunuchs.

The Sixteenth Imperial Dynasty.		*Tartars.*
Heoo-tsin.		
Kao-tsoo	936	Tay-tsong, continued.
Tchoo-tee	944	

Sixteenth dynasty.

During this dynasty, the Tartars of Leao-tong acquired the greater part of the province of Pe-tche-lee, and even compelied Kao-tsoo to send them an annual donation of 300,000 pieces of silk. By their assistance also, Lieu-shi euen, the general of Tchoo-tee's army, took possession of the throne; and, under the name also of Kao-tsoo, founded

Encroachment of the Tartars.

The Seventeenth Imperial Dynasty.		*Tartars.*	
Heoo-han.			
Kao-tsoo	947	Shee-tsong	948
Yn-tee	948		
Sian-yn-kong	950		

Seventeenth dynasty.

The short period of this dynasty was a continued struggle against the power of the encroaching Tartars; and it was while the forces of Yn-tee were engaged in resisting their progress, that the eunuchs excited a sedition, in which the emperor was slain. In the meantime, he was succeeded by his brother; but the imperial general Ko-hey, returning victorious from his expedition against the Tartars, was proclaimed emperor by the army; and, under the name of Tay-tsoo, founded

War with the Tartars.

The Eighteenth Imperial Dynasty.		*Tartars.*	
Heoo-tcheoo.			
Tay-tsoo	951	Moo-tsong	953
Shee-tsong	954		
Kong-tee	959		

Eighteenth dynasty.

As Kong-tee was only seven years of age at the death of his father, his guardian and prime minister, Tchao-quang-yu, who had rendered eminent services to the state, was invested by the grandees with the imperial dignity, and, under the name of Tay-tsoo, founded

The Nineteenth Imperial Dynasty.		*Tartars.*	
Song.			
Tay-tsoo	960	King-tsong	969
Tay-tsong	976	Shing-tsong	983
Tching-tsong	998	Hing-tsong	1032
Gin-tsong	1023	Tao-tsong	1056
Yn-tsong	1064	Tien-tsong	1102
Shing-tsong	1068	*Kin*, or *Niutche Tartars.*	
Tche-tsong	1086	Tay-tsoo	1118
Hoey-tsong	1101	Tay-tsong	1124
Kin-tsong	1126	Hee-tsong	1136
Kao-tsong	1127	Hay-ling-vang	1150
Hiao-tsong	1163	She-tsong	1162
Kuang-tsong	1190	Tchang-tsong	1190
Ning-tsong	1195	Tong-hay-hiun-heoo	1209
Lee-tsong	1225	Siuen-tsong	1214
Too-tsong	1265	Ngay-tsong	1225
Tee-hien	1275	Mo-tee	1235
Tuon-tsong	1276	*Mong-koo*, or *Mogul Tartars.*	
Tee-ping	1278	Tay-tsoo, Temoo-gin, or Genghis-Khan.	1206
		Tay-tsong, Octay-khan	1228
		Ting-tsong, Gaïook-khan	1242
		Hien-tsong, Mangoo-khan	1249

Nineteenth dynasty.

The most celebrated prince of this dynasty was its founder Tay-tsoo, who checked the incursions of the

Tartars, and restored the tranquillity of the empire, and was distinguished by his generosity and humanity, his love of learning, and abhorrence of luxury. During the reign of his successors however, the Tartars of the East, though frequently repulsed, made uniform encroachments upon the Chinese dominions ; and were generally arrested in their progress, not by the force of arms, but by the promise of an annual pension or tribute. In the reign of Ning-tsong, the power of the Western Tartars arose under the famed Genghis-Khan, and, by their assistance, the empire of the Eastern Tartars were completely subdued. These victorious allies, however, soon began to extend their conquests at the expence of their Chinese friends ; and, under the voluptuous reign of Too-tsong, gained easy and speedy possession of the Northern provinces of the empire. They next advanced into the centre of the country with immense forces, seized upon the succeeding prince, Tee-hien, who was only an infant, and sent him into the deserts of Tartary ; compelled his brother Tein-tsong, who was next placed on the throne, to take refuge in the most southern parts of Quang-ton, where he died in the second year of his reign ; attacked his successor, Tee-ping, a child like his two predecessors, who was then on board his fleet under the care of his prime minister ; and, after a most sanguinary contest, in which 100,000 Chinese are said to have perished, either by the sword or the water, gained a complete victory, and terminated the power of the Song-family. The conqueror, called Ho-pee-lie by the Chinese, and Kulbay-Khan by the Tartars, afterwards assumed the name of Shee-tsoo, and founded

Progress of the Tartars.

The Twentieth Imperial Dynasty.

YUEN, or MOGULS.

Twentieth dynasty.

Shee-tsoo, Kublay-khan	1260
Tching-tsong, Timoor-khan	1295
Voo-tsong, Dgenesek-khan	1308
Gin-tsong, Algiaptoo-khan	1312
Yn-tsong, Tchytepola	1321
Tay-ting, Yeson-Timor-khan	1324
Ming-tsong, Cooshee-lay-khan	1329
Ven-tsong, Daouat-moor-khan	1329
Ning-tsong, Hintchipan	1333
Shun-tee, Tocat-moor-khan	1333

Accession f Tartar rinces.

Shee-tsoo, though he was the first foreign prince that governed the Chinese nation ; yet, by adhering as closely as possible to their ancient laws and customs, by his love of learned men, and his respect particularly to the memory of Confucius, by his uniform equity, and paternal tenderness towards all his subjects, he effectually reconciled them to his government. He even caused a proclamation to be issued at his accession, permitting all persons to continue in the same offices, which they had enjoyed in the preceding reign ; and to this day the reign of his family is styled by the Chinese, "the wise government." He was the author of the statute, which appoints, that there should be but one calendar throughout the empire, which should be compiled at court, and published every year. He was the first sovereign, also, who removed the royal residence to Pe-kin ; and, to prevent the frequent shipwrecks, which took place among the vessels employed in bringing to the metropolis, by sea, the tribute of the southern provinces, or in carrying on the trade of the empire ; he constructed the great canal, which extends nearly 1500 leagues, as will afterwards be more particularly described ; and, which, besides being one of the greatest wonders of the country, is one of the greatest benefits, which had ever been conferred on the Chinese empire. The succeeding princes of this dynasty were all distinguished by their private virtues, as well as their excellent government ; but both they and their Tartar followers, became gradually enervated by the softer climate and luxurious productions of China. Shun-tee particularly, though in other respects a prince of considerable talents, sunk into habits of the most effeminate indolence, and yielded himself entirely to the influence of the Lamas of Tartary, who filled his palace with female singers and dancers ; and introduced such a system of idolatry and debauchery, as at once enfeebled the courage of the Tartar captains, and rendered them contemptible in the eyes of the nation whom they had subdued. In the 14th year of the reign of Shun-tee, a Chinese of the name of Shu, who had been originally a servant in a monastery of Bonzes, put himself at the head of a troop of insurgents, made himself master of several considerable cities ; repeatedly defeated the imperial forces ; compelled the emperor to take refuge in Northern Tartary ; and, ascending the throne by the name of Tay-tsoo, founded

ublic caendar.

The Twenty-first Imperial Dynasty.

MING.

Twenty-first dynasty.

Tay-tsoo	1368	Hiao-tsong	1488
Kien-ven-tee	1398	Voo-tsong	1506
Tching-tsoo-ven-tee, or Yong-lo	1403	Shee-tsong	1522
		Moo-tsong	1567
Gin-tsong-tchao-tee	1425	Shin-tsong	1573
Siuen-tchong-tchang-tee	1426	Kuang-tsong	1620
Yng-tsong	1436	Hee-tsong	1621
King-tee	1450	Hoay-tsong	1628
Yng-tsong, restored	1457	Hong-kuang	1644
Hien-tsong	1465		

Bloody contests with the Tartars.

The founder of this dynasty ascended the throne with universal applause ; and is celebrated as a prince of the greatest piety and wisdom. The empire, however, did not long enjoy the state of tranquillity and order, which he had established ; and scarcely a single reign occurs in the course of this dynasty, which is not marked with the most bloody intestine commotions, or repeated inroads of the Northern Tartars. About the latter end of the reign of Shin-tsong, the Niu-tche, or Eastern Tartars, who had been reduced by the Western Tartars, in the time of Genghis-Khan, again recovered their strength, reunited their scattered principalities under one sovereign, and commenced a succession of attacks upon the empire of China, which terminated at length in its total subjugation. About the year 1617, the Chinese mandarins had conducted themselves with unjustifiable insolence towards the Tartar merchants residing in Leao-tong ; and had proceeded so far in their aggressions, as to put their prince to death, after having treacherously got possession of his person. Tien-ming, the son of the deceased king, entered the Chinese territories at the head of a powerful army ; but sent a proposal to the emperor, in which he engaged to withdraw his forces, upon receiving satisfaction for the injuries, which he had sustained. The mandarins, to whom the letter was communicated by the emperor, professed to hold its author in the utmost contempt, and disdained to vouchsafe any answer whatever ; which exasperated the Tartar prince to such a degree, that he vowed to sacrifice 200,000 Chinese to the manes of his murdered father. He marched an army of 50,000 into the province of Pe-tche-lee ; but, being checked in his progress by the Chinese forces, he

Origin of the Tartar invasion.

retired to Seao-tong, where he assumed the title of Emperor of China. Two years afterwards he drew the imperial forces by a stratagem into the wilds of Tartary, where he surrounded and cut to pieces the whole army; and, advancing with his victorious troops into China, destroyed a second army, which had been sent to oppose his progress. Under the reign of Hee-tsong, who was assisted by auxiliaries from Corea, by an Amazonian lady at the head of several thousand men from the province of Se-tchuen, and by Portuguese engineers from Macao, the Tartar prince was again compelled, for a short time, to evacuate his conquests. But having discomfited the neighbouring powers, who had taken the opportunity of his absence to invade his dominions, (and whose hostile demonstrations had probably tended, more than the prowess of the Chinese armies, to occasion his retreat,) he returned to the invasion of China with redoubled fury, gained possession of the city of Pekin, and commanded all the Chinese inhabitants, under pain of death, to shave their heads after the Tartar fashion; on which occasion, it is said, that several thousands of them chose rather to lose their heads, than their hair. After the death of Tien-ming, the leader of the Tartars, who was succeeded by his son Tay-tsong, a prince of a mild and compassionate disposition, the Chinese empire was so much distracted by rebellions in different quarters, that it was necessary to direct all the strength of the army to their reduction; and negotiations for peace were opened with the Tartar Prince, which appear to have been in some measure successful.

Reluctance of the Chinese to shave their heads.

Tien-tsong was succeeded in Tartary by his son Tsong-te, a prince of the most affable manners and polite accomplishments, who had been privately educated among the Chinese, and was intimately acquainted with their literature and customs. On these accounts, he was highly esteemed by many of the Chinese mandarins, who, disgusted by the temper of the old Emperor Hoay-tsong, which had been soured by the troubles of his reign, transferred their services to the Tartar court. In the meantime, every province almost in China was infested by bands of robbers or rebels, which were at last collected into two distinct armies; whose commanders, Lee and Shang, agreed to divide the empire between them. The former, after gaining various successes, and committing the most barbarous cruelties upon the adherents of the emperor, approached the capital, at the head of an army of 300,000 men. The city was strongly garrisoned, and might have resisted all the attempts of the usurper, but the troops of the government were divided into a multitude of rival factions, and filled with numerous partisans of the rebel general. The emperor himself, partly from the neglect of his officers, and partly from his own indolence, had been hitherto kept in extreme ignorance of the true state of affairs; and remained shut up in his palace, occupied in practising the superstitions of the Bonzes. When at last aroused to a sense of his situation, he found his capital betrayed to the enemy, his palace surrounded by his rebel subjects, his attendants and officers fled, and every avenue of escape shut up. Retiring in despair with his family, his prime minister, and a few faithful eunuchs, into a distant part of his gardens, they with one consent sought a refuge by death from the insults of the victor. The rebel seated on the throne, treated with the utmost indignity the dead body of the unfortunate monarch, when it was brought into his presence, and commanded the remainder of his family and adherents to be put to death. Every one hastened to secure himself from a similar fate, by making submission to the usurper, except Oo-san-hoey, the governor of Leao-tong, who obstinately refused to acknowledge his authority. Lee, (or Lie-tse-ching,) carrying with him the father of Oo-san hoey, invested the faithful viceroy in the capital of his province, shewed him his aged parent loaded with irons, and vowed to put him instantly to death, should he refuse to submit. The brave Oo-san-hoey, bursting into tears at the sight, fell upon his knees, and besought forgiveness of heaven, if he should still persist in his allegiance at the risk of his father's life, who approved the resolution of his son, and calmly submitted to his fate. Determined to avenge at once the death of his prince and his parent, he made application for aid to the Tartar sovereign Tsong-te, who instantly joined him with an army of 80,000, and compelled the usurper to retire to Pekin. Tsong-te died almost as soon as he had entered the Chinese dominions, after having committed the charge of his son and his empire to his brother A-ma-van. The young Tartar prince, Sun-shee, who was only seven years of age at the decease of his father, was speedily conveyed to Pekin, and welcomed by the people as their deliverer, with the most joyful acclamations. In the mean time, a grandson of Shin-tsong, and relative of the late imperial family, was proclaimed emperor at Nankin, under the name of Hong-kuang, and had the greater part of the nine southern provinces under his authority. The rebel Lee also was still at the head of a powerful army, which he basely employed rather in plundering and massacring the defenceless people, than in boldly contesting the throne with his competitors. Thus was the empire of China assumed by three separate and powerful claimants; and rendered, for several years, a theatre of war and bloodshed. The Tartar forces under the command of the three uncles of Sun-shee speedily triumphed over all opposition. Oo-san-hoey, assisted by the Tartar army, was indefatigable in the pursuit of the blood-thirsty Lee, compelled him at length to take refuge in the mountains of the west, with a few desperate followers; and, according to some accounts, slew him in an engagement with his own hand. One of the uncles of Sun-shee was then dispatched to the south against Hong-kuang, who was driven from his capital, taken prisoner in his flight, and put to death on the spot, or, according to some accounts, afterwards strangled at Pekin. He is said to have been an amiable prince, who had been carefully educated by the former emperor; and who, as the last refuge of the Chinese, had been urged, against his inclination, to accept a crown, which he had not the power to maintain. Sun-shee, remaining sole master of the empire, ascended the throne by the name of Shee-tsong, and founded

Rebels.

Heroic patriotism.

Final subjugation of China by the Tartars.

The Twenty-second Imperial Dynasty.

Ta-Tsin.

Mantchoo Tartars.

Shee-tsong	1644	Kien-long	1736
Shin-tsoo-gin or Kang-hee .	1662	Kia-king	1796
Shee-tsong-hien or Yong-tching	1723		

Twenty-second dynasty.

During the space of ten years after the accession of this dynasty, new claimants, connected with the former family, continued to raise the standard of resistance; and even governors of provinces, without any personal views to the sovereignty, obstinately refused to submit to the Tartar sway. In the province of Se-tchuen Long-voo, or Jan-van, a descendant of the former dynasty was proclaimed emperor of the Chinese: and was supported in his pretensions by the celebrated sea-captain Tchin-tchi-long, or Ikoan, of whom the following account is

Celebrated sea-captain.

given. He was born of very obscure parents in the province of Fo-kien, and went to Macao to make his fortune among the Portuguese, where he became a convert to Christianity, and took the name of Nicholas Gaspard. Thence he repaired to Japan, where he entered the service of a wealthy merchant, and became at length the commander of his trading vessels to Cochin-China, Camboia, and other places. While he was on a voyage at Camboia, having heard, that the merchants, with whose commodities he had been entrusted, had been carried off by a pestilence which raged in Japan, he immediately applied to his own use the property in his hands, purchased a number of armed vessels, and became the most formidable captain of pirates, that had ever been known in the Chinese seas. In alliance with another commander, he plundered all the ships, without distinction, which came in his way, and bid defiance to all the fleets of the empire. The emperor, unable to reduce these naval chiefs by force, wrote, at the same time, a letter to each of them, expressing his high sense of his valour, and of the services which he might render to his country, inviting him to join the imperial navy in subduing the other piratical fleet, and promising him in recompense the office of captain-general of the sea-coasts, and admiral in chief of the sea-forces. Tching-tchi-long, though he suspected the artifice, yet, depending upon his strength and good fortune, instantly made sail to attack his fellow pirate, whom he vanquished and put to death, after a desperate engagement; took the greater part of his ships and crew into his service; and thus, become more powerful than ever, boldly advanced to meet the imperial fleet, which, instead of attacking, as was intended, the remaining pirate, weakened, as they expected, by his conflict with the other, were glad to congratulate him upon his success; whilst by virtue of the emperor's letter, he immediately commenced the functions of high admiral, and required all the trading vessels of the empire to receive their passports from his hand, for which he exacted enormous sums, to the great detriment of commerce and of the maritime provinces. By bribing the favourite eunuchs and chief officers at court, he prevented the numerous complaints against him from reaching the ears of the emperor; and raised himself to such a degree of power, that no one dared to question his actions. On one occasion he went ashore at Canton, where the imperial officers had withheld a part of his revenue, as admiral of the fleet; entered their populous city with only 6000 of his men; erected a tribunal in one of the public squares; and, having summoned the officers in question, together with some lawyers, into his presence, obliged them instantly to pay him the money which he required, gave them receipts in form, and returned to his fleet without any obstruction. Upon the death of the Emperor Hoay-tsong, he might have seized upon the crown with greater prospect of success, than either of the rebels Lee and Shang formerly mentioned; and it is said, that in the event of his making such an attempt, he had a promise from the Dutch traders at Formosa to assist him with all their forces. But he transferred his allegiance to Long-voo, as the only remaining representative of the imperial family; and rejected with scorn all the attempts of the Tartar monarch to gain him to his interests. After engaging the armies of that prince in several bloody battles, with varying success, he was taken prisoner and sent to Pekin; but, as his son was still at the head of his powerful fleet, he easily found means to secure his own safety, by engaging to support the Tartar interest. Long-voo, either unable to stand without the aid of Tching-tchi-long, or, as others pretend, having been betrayed by his means into the hands of the other party, was deprived at once of his life and crown. Still the provinces of Quang-see and Quang-tong refused to submit.

Opposition to the Tartars.

Against the latter, where a young prince of the late imperial family had been proclaimed, one of the uncles of the Tartar emperor, named Peli-poo-wang, was sent with a powerful army in the character of viceroy. The Chinese troops never attempted to face the enemy; but, according to some authors, the city of Canton stood a twelvemonth's siege with great spirit; and was, on that account, given up by the Tartar general to be plundered, three whole days. The young emperor and his adherents were put to death; and the inhabitants subjected to every species of cruelty and insult. The rest of the province was soon reduced, except the town of Shao-king, where another young prince, named Yoong-lo, had been proclaimed emperor by the viceroy of Quang-see, Thomas Kioo, and the late generalissimo of the Chinese army, Luke Shin, both of whom were Christian converts and brave commanders. The chief counsellor of this prince was a Christian eunuch named Pan-Achilles, by whose means the Jesuit missionary Andrew Koffler was brought to instruct the monarch and his family in the truths of Christianity, and it was hoped that he might one day prove the Constantine of China, by which name he was in that view baptized. The Tartar army, after the reduction of Canton, marched without delay against this new competitor, but were engaged with great intrepidity, and completely routed by Kioo and Shin. The report of this victory, and of the election of a new emperor, spreading through the neighbouring provinces, revived the courage of the Chinese; and a new army, appearing in Fo-kien, gained several cities from the Tartars; while Tchin-tchi-kong, called by the Dutch Coxinga, son of the celebrated Tchin-tchi-long, taking part with the imperial family of China, made great progress in subduing the towns on the sea-coast. His success, however, was of short duration; and, having received a total defeat from the Tartars, he was driven out of China, and obliged to retire to his fleet. New armies sprung up in every quarter against the conquerors; and battles were fought with various success. The viceroy of Kiang-see shook off the yoke, and defeated the Tartars in several engagements. Two chiefs in the northern districts, whose names were Ho and Kiang, uniting their forces, gained a great victory over the Tartars; and kept the field for a considerable period without opposition. Yoong-lo resisted all their attempts upon the city of Shao-king; and, having put himself at the head of his troops, repulsed them a second time from the frontiers of his province.

Formidable opponent to the Tartars, and bloody oppressor of the Chinese.

But the most terrible of all their opponents was a chief named Tchang-hien-tchang, who was rather a general murderer and robber, than a competitor for the crown, or a commander in any interest. He completely expelled the Tartars from the western provinces, where he is said to have committed barbarities altogether incredible; and governed everywhere in the most tyrannical and ferocious manner. If any one under his jurisdiction committed an offence of the most trivial nature, he commanded the culprit, and all who inhabited the same street, to be put to death. He caused 5000 eunuchs to be murdered, because one of them refused to acknowledge him as emperor; and butchered, in like manner, 10,000 learned men, because he regarded them as hostile to his pretensions. Upon leaving the capital of Se-tchuen, he ordered the inhabitants to be led out of the city in chains, and to be massacred in the fields, to the number of 60,000. He called upon his troops to murder all their wives, because they were an incumbrance in time of war, and gave them an example, by cutting the throats of 300 of his own women. He pretended to be a friend to the Christians, and to have received a commission from heaven to root out every other system of faith. Advancing to meet the Tartar army in Shen-see, he was shot through the heart with an arrow, while he was reconnoitring unarmed in the front of his troops; upon which, his soldiers immediately dispersed, and submitted to the Tartar emperor. By stratagem rather than by force, by sowing divisions among the Chinese commanders, and by the effect of promises and bribes, the Tartars succeeded at length in regaining all the places which had revolted; and Yoong-lie, being hard pressed in his capital, was compelled to take refuge in the court of Pegu; but was afterwards delivered up at the demand of Shee-tsong, by whom he was ordered to be strangled at Pekin. It was chiefly owing to the wise policy and humane conduct of A-mavan, the uncle and guardian of the young Tartar prince, that the Chinese were so easily subdued, and so completely reconciled to the authority of the new dynasty. Shee-tsong faithfully adhered to the system, which his uncle had adopted in governing the empire. He ascribed his great success, not to the number or valour of his troops, but to the will and favour of heaven; a sentiment exactly coinciding with the Chinese creed, and furnishing them with an excuse, which they plead to this day, for submitting to a foreign yoke. Instead of shutting himself up in his palace, according to the custom of the Chinese emperors, he began his reign with shewing himself much in public, and giving his subjects free access to his presence. He gained their attachment, above all things, by the respect which he paid to their whole system of government, laws, and customs. Nothing was changed, that could be regarded as of any importance; but, on the contrary, the conquerors conformed almost in every respect, to the manners of the vanquished; married into Chinese families, studied the Chinese language, adopted the Chinese dress, and mixed completely with the common mass. The ablest Chinese were appointed to the civil departments, in preference to Tartars; the superstitions of the country were upheld and encouraged; and the people were scarcely sensible of any change having taken place in the administration of public affairs. The army alone was reserved for the Tartars; and is still chiefly composed of the countrymen of the emperor.

Wise policy of the Tartar prince.

Jesuit missionaries patronized.

Shee-tsong greatly patronised men of learning; and shewed extraordinary favour particularly to the persons employed in the Jesuit mission to China. Adam Schaal was made president of the tribunal of mathematics, and intrusted with the reformation of the calendar, an office which had been held by the Mahommedans nearly 300 years. This eminent Jesuit was honoured by the emperor with the appellation of *Ma-fa*, "my father," and enjoyed the special privilege of presenting his petitions into his own hands, without subjecting them to the examination of the usual tribunals. About eight years after Shee-tsong had taken the reins of government into his own hands, the renowned sea-captain Tching-tching-long, or Coxinga, again appeared upon the coast of China with his numerous fleet, and at length laid siege to the city of Nan-kin; but his army, having devoted themselves to feasting and amusements for three days, in celebration of his birth-day, the besieged embraced the opportunity to make an attack upon his camp at midnight, while the soldiers were oppressed with wine and sleep, and drove them to their ships with great slaughter. Enraged by this defeat, he pursued the Tartar fleet, destroyed a number of vessels, took 4000 prisoners, and after having barbarously cut off their noses and ears, he sent them all ashore, where they were still more barbarously put to death by their own government, as a punishment for having yielded to a rebel, but, in reality, as a mean of concealing the disgrace of the discomfiture. Coxinga, after this victory directed his course to attack the island of Formosa, which was chiefly occupied by Dutch traders; and, after a blockade of four months, compelled them to surrender from want of provisions. The Dutch, however, were permitted to carry off their property; and the part of the island, which had been occupied by the Chinese, was formed by the pirate chief into a small kingdom.

Death of the Emperor Shee-tsong.

The emperor Shee-tsong, about the 17th year of his reign, while he was only 24 years of age, died of grief on account of the loss of one of his queens, after having made an attempt to deprive himself of life. While he was upon his death-bed, he called four of his chief mandarins into his presence, and charged himself before them with various faults during his government, with ingratitude to his most faithful minister, neglect of the counsels of his mother, affection to the eunuchs, extravagance in vain curiosities, and inordinate attachment to the late queen. He next appointed them guardians of his youngest son Kang-hee, whom he declared his successor, and who was then only eight years of age. Then, calling for his imperial robe, he covered himself with it in his bed, and instantly expired.

Accession of Kang-hee.

The guardians of the young monarch devoted themselves to the welfare of the empire. They began their administration with wisely expelling all the eunuchs from the palace except about 1000, who were reserved for performing the lowest offices. They next published an edict, requiring all the inhabitants of the sea-coast to withdraw three leagues from the sea, and all maritime commerce to be abandoned; which impaired, indeed, as they are supposed to have intended, the power of Coxinga, but which also completely ruined an immense multitude of Chinese families, who subsisted by fishing. They next issued a severe edict against the Christians, who were soon after compelled to leave the empire, as will afterwards be more particularly related. Oo-san-hoey, who had invited the Tartars into China, and who had received from Shee-tsong a district in Shen-see, with the dignity of king, is represented by the Chinese historians, as having soon repented his error in calling the Tartars to his aid, saying that "he had sent for lions to drive away dogs." In the 12th year of the emperor Kang-hee, he openly raised the standard of rebellion, made himself master of several western provinces, and exercised the prerogatives of the emperor. At the same time, two of the southern princes declared war against the Tartar government, and were joined by Tching-tching-may, the son of Coxinga, and now king of Formosa. But these insurgents soon quarrelled with each other, and made their submission to Kang-hee; while Oo-san-hoey, after sustaining several successive defeats, sunk under the load of years, the fatigues of war, and the pressure of grief and disappointment. His son Hong-hoa, nevertheless, supported his father's views, and assumed the title of emperor; but was soon reduced to such extremities by the Tartar generals, that, to avoid falling into their power, he put himself to death. About this time, a dreadful earthquake was experienced in the northern parts of the empire, and at Pekin alone, 300,000 persons are said to have been buried in the ruins of their habitations. Kang-hee, who, even in his youth, had discovered the greatest talents for governing, as soon as the different insurgents had been completely suppressed, made a visit to his native dominions in Eastern Tartary, accompanied by his

Intestine commotions.

family, his court, and an army, it is said, of 70,000 men. He made a similar visit, during the following year, to Western Tartary; and continued annually to repeat these expeditions, under the pretence of hunting, but in reality for the purpose of keeping his troops in exercise, of displaying the grandeur of his court, and of awing the vassal princes, who were required to join him in his progress.

Influence of the missionaries.

By the assistance of two of the missionaries, Father Gerbillon and Pereira, the boundaries between the Russian and Chinese dominions were amicably defined in the year 1689. In 1693, the emperor was restored by the medicines of the missionaries from a dangerous attack of fever; and in gratitude for their services in this instance, as well as through the influence of Gerbillon and Pereira, who instructed him in the European sciences, he extended a greater degree of toleration to the Christian religion, and conferred several important privileges upon the Jesuit residents in Pekin.

Survey of the empire.

In the year 1707, the emperor employed these learned missionaries to make a map and survey of the empire; a work which they accomplished with great labour in little more than ten years, and which does honour both to the prince who planned, and to the persons who executed the vast undertaking. In 1722, the emperor Kang-hee, after having established his empire in profound peace, and done more for its improvement than any sovereign who had ever filled the throne, died suddenly in the 69th year of his age, and the 60th of his reign.

Death and character of Kang-hee.

He was a prince of a truly enlarged mind, and possessed of many estimable qualities; indefatigable in his application to public affairs; cautious and discerning in the choice of his ministers; singularly frugal in his personal expenditure, but munificent and affectionate towards his people; an anxious promoter of peace, both in his own dominions and among neighbouring nations; friendly to the arts and sciences, which he cultivated himself with distinguished success; addicted to an active mode of life, and skilled in the military exercises of his nation; uniting in his personal character the most manly corporeal and mental endowments, and in his political administration, the tenderness of a parent with the firmness of a prince.

Accession of Yong-tching.

He was succeeded by his fourth son, whom he had nominated to the throne, and who assumed at his accession the name of Yong-tching, which signifies "perpetual peace." The new emperor, entering upon his function in the prime of life, applied himself with the utmost assiduity to the discharge of his weighty duties. He is said to have employed whole days and nights, without interruption, in framing useful laws and regulations; and to have been particularly attentive to receive and answer the numerous memorials presented for his inspection. The most effectual way to gain his favour was to propose some scheme, which tended to advance the public good, or to provide relief for his subjects in times of calamity. Except his thirteenth brother, he had no confidents in his measures; but governed wholly of himself, and with the most absolute authority.

Persecution of the Christians.

He is said to have been endowed with great wit and eloquence, but to have been less addicted to scientific pursuits than his father. He began his administration with issuing the most severe edicts against the Christians, whom at length he utterly proscribed and banished from his dominions; and, notwithstanding the excuses, which may be alleged for this measure, from the misconduct of the missionaries, it is impossible to vindicate the cruel persecutions, which he instituted against the native converts, and in which so many of the noblest families were miserably destroyed.

Dreadful earthquake.

In the year 1731, another destructive earthquake was experienced in the northern provinces, in consequence of which 100,000 persons were said to have perished in Pekin, and a still greater number in the neighbouring country. The emperor was residing at the time in one of his pleasure houses, about two leagues distant from the metropolis, and was sailing in his barge upon the canal in his gardens, when the shocks commenced. His palace was instantly reduced to a heap of ruins, and the emperor, who had fallen on his knees at the sight, afterwards published an edict in the usual stile, ascribing the calamity to the wrath of heaven against himself, for his offences and want of care in governing the people; commanded an estimate to be made of the losses, which had been sustained; and issued large sums for the relief of the sufferers.

Accession of Kien-long.

Yong-tching died in the year 1736, after a reign of thirteen years, and was succeeded by his son Kien-long, who ascended the throne without opposition, though he had not been regularly declared by the late emperor as his successor. He had hitherto devoted himself entirely to literary pursuits, and was little acquainted, at the time of his accession, with public affairs; but his mild and benevolent character speedily attached to him the affections and applause of his people. In 1746, new decrees were issued against the missionaries, a few of whom, however, were still permitted to reside at Pekin, on account of their services in matters of science. In 1753, an insurrection was excited among the Eleuth Tartars, by a powerful prince named Amoursana; but the approach of a Chinese army compelled him to take refuge in the deserts of Siberia, where he died a few years afterwards. Kien-long sent a message to the Russians, requiring the dead body of Amoursana to be delivered up to him, that it might be subjected to the customary penalties, for the intimidation of others; but the Russians, while they shewed the body of the prince to the Chinese commissioners, in order to satisfy them of his decease, refused to commit it into their hands, as their laws, it appears, prohibit any exposure to indignity of the remains of unfortunate persons, who may take refuge in their dominions. In the year 1770, about 50,000 families of the Tourgouth Tartars, in the Russian territories, migrated to the frontiers of China, and were afterwards followed by an additional number, which made the whole amount to nearly half a million of souls. The Chinese monarch was so much gratified by the accession of so many new subjects, and by the testimony of approbation which it afforded of his government, that he caused a monument of stone to be erected in commemoration of the event, with an inscription in four different languages. In the year 1782, the emperor shewed his vigilance over the administration of public affairs, and his regard for the welfare of his subjects, by punishing a great number of persons of the highest rank, who had been found guilty of embezzling the revenues, and oppressing the people, while he diminished the amount of taxes upon the lower classes of the community, and promoted the learned men throughout the empire according to their merit.

Insurrection of the Mahometan tribes.

In the year following, the tranquillity of the empire was interrupted by a dissension among some tributary Mahometan tribes on the western frontiers; and the more turbulent families, to the number of 10,000, having been punished by the Chinese governor with banishment to a more distant residence, they excited the tribes, among whom they had retired, to throw off the yoke of the Chinese emperor, and extended the spirit of revolt to the confines of Bucharia. Having secretly secured adherents among the people, where they had formerly resided, and procured a considerable quantity of military stores, they placed themselves under the command of a rebel chief, who had formerly experienced the emperor's clemency, and erected a strong fort in a situation that was deemed inaccessible. Their commander was defeated at the head of 10,000 men, and taken prisoner by the Chinese, before the Mahometans had collected their forces. But the chiefs who came to their assistance, to the number of the different tribes, having found themselves, when united, not less than 100,000 fighting men, immediately commenced offensive operations. The Chinese governor injudiciously sent out small detachments, which were successively cut to pieces; and the insurgents, losing no time in the attack of fortified places, penetrated into the midst of the empire, destroying every thing in their progress with fire and sword, seizing upon the public magazines and treasures, and sacrificing the governors who ventured to oppose them. A numerous army, however, was speedily marched against them, under the command of the prime minister; and they were compelled to retreat to their stronghold, which was protected by a considerable river and lake in the front, and in the rear by a very steep and lofty mountain. While they imagined themselves secure in this retreat, the Chinese commander caused the course of the river to be turned by his numerous workmen, and his troops to advance to surround the lake. The insurgents, being thus at once deprived of their strongest protection, and regular supply of water, were reduced to the greatest extremities. After enduring the torments of thirst for the space of three days, they adopted the desperate resolution of putting to death the useless persons among them, and of cutting their way through the Chinese army. They were completely overwhelmed in the daring attempt, their fortress taken by storm, and the whole of its defenders put to the sword, except a few of the leaders, who were afterwards executed at Pekin. This victory was followed by an order from the emperor to exterminate the whole nation, excepting those who were under 15 years of age, who were to be distributed as slaves among the Mahometan tribes, that had remained faithful to the emperor. This barbarous decree was rigorously carried into effect, and a tract of country, above 100 leagues square, containing 1000 towns and villages, was converted into an empty desert.

Destructive inundation.

In the year 1788, while the emperor, though now at the age of 78, was engaged in his usual recreation of hunting in the deserts of Tartary, a sudden inundation descended from the mountains, and flooded the whole adjacent country. It was with difficulty, that Kien-long gained a small elevation, where he passed a whole day without food, till a slender bridge was thrown across the hollow, by which he succeeded in saving himself, though a great number of his attendants were sweeped away by the torrents.

British embassy.

In the year 1793, a splendid embassy, under Lord Macartney, a nobleman of distinguished talents and accomplishments, was sent by the king of Great Britain to the Emperor of China, with a view to establish a more direct intercourse with that immense empire, and to secure more extensive commercial privileges for the British nation. The embassy was received by the Chinese government with every mark of respect; but completely failed in attaining the desired object. This want of success has been ascribed to various causes; to an imprudent assertion in an English journal on the subject, which found its way to China, and awakened the suspicion of its rulers; to the refusal of Lord Macartney to observe the established ceremony of prostration before the Chinese emperor; to the dread of Jacobin principles, which had already been introduced into China, and which augmented the aversion of the government to all European settlers; and to an oversight of the British ambassador, in not having treated, in the first instance, with the Ho-tchong-tang, or prime minister of China, whose influence is understood to be greater than that of the emperor himself. But, while each of these causes may be allowed to have had its weight, the true reason is unquestionably of a more general nature; and must be sought in the spirit of the Chinese people, proud, contemptuous, and suspicious, towards the inhabitants of every other country. This was sufficiently demonstrated in the fate of the Dutch embassy, which entered China with similar views in the following year. Though they carefully attended to every circumstance, which they supposed their predecessors to have overlooked, and meanly complied with the most humiliating requisition on the part of the Chinese; they were neither treated with so much respect as the English, nor were they, in the smallest degree, more successful in their object. All that they obtained was a sight of the emperor, a few trifling presents from his hand, and an exemption of the ship, which conveyed their ambassador, from the payment of any duties upon its cargo.

Dutch embassy.

Abdication of Kien-long, and accession of Kia-king.

In the year 1796, the Emperor Kien-long, according to a resolution which he had long entertained, abdicated the throne in favour of his son, after a reign of 60 years, and died in the year 1799, at the age of 89 years, with the character of an enlightened, humane, pacific, and prudent prince. He was succeeded, according to his own appointment, by his seventeenth son Kia-king, who had then attained the age of 40 years; but of whose reign and character, from the want of intelligence from China, we can present only a few detached circumstances. Immediately after the death of the old emperor, the prime minister, from some cause which is not known, was brought into disgrace, and compelled to become his own executioner. By accounts received from Canton, in the beginning of the year 1802, it is known that a strong and well-disciplined body of Tartars had made an incursion into China in the year 1800; an invasion which excited universal terror, especially as it was connected with serious internal commotions. Several districts were in arms at the same moment; but the imperial troops, by a prompt movement, brought the insurgents to action before they could be joined by the Tartars, and routed them with immense slaughter.* One of those severe droughts, which are so frequent in China, had prevailed about the same time in the eastern districts; and the natives had been reduced to the necessity of abandoning large tracts of country in quest of food, while the most benevolent exertions on the part of the emperor had not been able to impart much relief. The Chinese government, it was also learned by the same intelligence, having discovered, that the greatest evils result from the abuse of opium, entirely prohibited the importation of that article into the empire.

In 1804, intelligence was received in Europe, that another serious rebellion had broken out in the western provinces of China, and had even extended to that of Canton, where a descendant of the former imperial family had appeared at the head of 40,000 men, who were all animated by a prophecy current in the country, that the present Tartar dynasty was to be overturned in the course of that year. The emperor had issued an edict,

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* A specimen of a Chinese Gazette, during this expedition, is published in Sir G. Staunton's translation of the penal code of that empire.

Success of the missionaries, and proscription of Christianity.

Vaccination introduced.

permitting the Roman Catholic missionaries to reside in any part of his dominions, within 20 miles of his court; and some thousands of children, with a few adults, had been baptized. In 1805, they are said to have had not less than 64 Christian seminaries of education, chiefly in the province of Se-tchuen; but, in 1806, Christianity was again proscribed; a Catholic missionary in Pekin was condemned to perpetual imprisonment; a number of civil and military officers were subjected to punishment, for permitting or aiding the labours of the missionaries; all the native converts were sent into banishment or slavery, and their books, papers, and printing blocks publicly burned. The truths of revelation, however, had been taught in numerous churches; and are supposed to have made impressions upon the minds of the natives, which even the persecutions, to which they have been exposed, will not speedily efface. About the same time, Sir George Staunton succeeded, with the assistance of Mr Pearson, surgeon to the British factory at Canton, in establishing the practice of vaccination in that populous city. The virus was obtained from Manilla, through the medium of the Spaniards. Mr Pearson wrote a concise treatise on the discovery and the mode of operation, with figures of the vaccine pustule; of the arm, with the proper place of puncture; of the lances charged with the matter, &c. This treatise, the first English work published in China, was translated by Sir G. Staunton, into the language of the country, and was gratuitously distributed at the expence of the East India Company, with the assistance of a Chinese surgeon. So far have the Chinese overcome their prejudices against European customs in this instance, that a general inoculation for the cow-pox took place in Canton, and a large subscription was raised by the natives, for establishing an institution in that city, by means of which the matter may be disseminated into every province of the empire.

Misunderstanding between the Chinese and British at Canton.

In the month of October 1806, a serious misunderstanding was occasioned between the Chinese government and the British factory at Canton; which originated in a scuffle on board an East India ship, between a native of the country and one of the crew, in which the former received a blow from a handspike, which afterwards occasioned his death. The Chinese government demanded, that the Englishman should be given up for capital punishment, or at least another of the same nation in his place, according to the laws of their country. But the offender had absconded, and all the British sailors denied any knowledge either of the deed itself, or of the person who had been the perpetrator. This answer, however, did not satisfy the Chinese; and all the British subjects were ordered to go on board their ships, and to quit Canton without delay. But the English commanders, having expostulated strongly upon the injustice of these measures, and supported their representations with some valuable donations to the relations of the deceased, the matter was at length amicably adjusted, and the usual intercourse again restored. In all the transactions, which occurred during this season of partial hostility, a Portuguese priest, named Father Rodrigo, who acted as interpreter to Admiral Drury, bore a very active and prominent part. This person, possessed of great courage and enterprise, had, previous to this event, succeeded in making his way, under the disguise of a Tartar, to the city of Pekin; and, after residing a considerable time in that capital without being discovered, returned in safety to Macao. This clandestine visit afterwards becoming known to the government at Canton, the Chinese mandarins expressed the strongest indignation, on account of the imposition and insult which had been practised upon them; and their resentment against the offender was rendered doubly inveterate, by his zealous interference in support of the British interests, especially by his spirited conduct upon the occasion of Admiral Drury's visit to Canton with the armed boats of his fleet. When the Chinese opened a fire from their fort and war boats upon the admiral's barge, Rodrigo stood erect upon the stern sheets, and, taking his cowl in hand, cheered with three loud huzzas; intending, as the Chinese alleged, and as was probably the truth, to incite the seamen to an immediate attack. The Chinese silently remarked his hostile demeanour towards them in the whole course of the dispute, and determined to seize the first opportunity of inflicting vengeance. As soon, therefore, as the British ships and troops had taken their departure, the father was treacherously enticed beyond the Portuguese boundaries, and carried prisoner to Canton; where the Chinese, glorying in the possession of their captive, unequivocally evinced their determination to make him atone, with his life, for the insults, which he had offered to the dignity of their empire. The Portuguese government, however, at Macao, feeling the necessity of protecting their subjects, and perceiving, that nothing but an appeal to force could effect the liberation of Rodrigo, commanded a ship of war and an armed brig to be moored, as close as the water would admit, to the two neighbouring Chinese forts; and, at the same time, marched their troops out of Macao, to invest the fortresses on the land side. Mr Roberts, also, the senior British supercargo, issued orders to all the company's ships to suspend their intercourse with the shore, and to prepare for such offensive measures as might appear requisite. These arrangements having been made, the Father was demanded in due form, with an explicit declaration, that unless he was delivered up without injury, and without delay, the Chinese forts should instantly be assaulted, and every man in the garrisons made responsible, with his life, for the safety of Rodrigo. The Chinese officers, whose unreasonable caprices require to be occasionally met with proper firmness, perceiving the determination of the Portuguese to carry their threats into execution, prudently acquiesced in the demand; and Rodrigo was triumphantly restored to his freedom and friends.

Their jealousy of the British.

It is asserted, that, notwithstanding the restoration of our commercial intercourse at Canton, the principal mandarins of that place have conceived a rooted prejudice against the British, which may not easily be removed; that they attribute every misfortune which befals any of their people in their transactions with us, to a systematic intention on our part to do them an injury; and that, upon the slightest pretext being afforded for complaint, they represent the matter to their superior tribunals in the most exaggerated form.

State of the Chinese government.

Five emperors of the Tartar race in succession, and all of them men of good understanding and vigorous minds, have now continued, without interruption, to rule over the Chinese empire; and have thus, it may be supposed, completely established their family in the supreme power. Recent occurrences, however, begin to indicate a more unsettled state of things in that country, and at least to shew, that the administration of so vast an empire is becoming daily a more difficult task. The Tartars, increasing in security, have become less attentive to conciliate the Chinese; and all the high offices are filled with the countrymen of the sovereign. It is suspected, that the government entertain a design of introducing the Man-tchoo language into general use, instead of the Chi-

[illegible], as great attention has been paid to its improvement, and as all the children, one of whose parents is of Tartar descent, have been expressly required to be instructed during their infancy, and to pass their public examinations, in the Man-tchoo tongue. The Emperor of China, like all oriental princes, shews no tendency to become indigenous to his adopted soil, but continues invariably attached to his native cast, and systematically favours his countrymen in every possible instance. The Tartars in China, it has been asserted by an eye witness, thus continue, from prince to peasant, to preserve their native character distinct, and to hold the subjugated Chinese in the utmost contempt. These, on the other hand, are represented as daily becoming more dissatisfied with the imperious manners of their conquerors, whom they heartily hate, while they are obliged to submit to their sway.

Power of the pirates.

A kind of piratical republic has been gradually forming upon the coasts, which, since the year 1805, has become extremely powerful. The number of the rebel vessels has been stated, by recent accounts, as not less than 4000; of which the largest are about 200 tons burden, carrying from 200 to 300 men, and from 12 to 20 guns; while the smallest are about 30 tons, with 50 or 60 men. In the beginning of the year 1810, they even attempted to blockade the port of Canton; and though they have not yet penetrated into the interior of the country, they are said to have numerous partizans in every quarter.

Seditious societies.

During the last twenty-five years, there has existed in China, particularly in the southern and western provinces, a kind of sect or association of disaffected persons, who furnish the rebels with all necessary intelligence. This association is named Thian-thee-ohe, which signifies "heaven and earth united:" and its members are extremely numerous. They know each other by private signs, such as the manner in which a cup of tea, or a pipe of tobacco, is offered and accepted. In the form of initiation, the new member is placed between two naked sabres, which are crossed over his head; and, in this position, he solemnly swears rather to perish than to betray the secrets of the society. A few drops of blood are then drawn from him, and from the person who administers the oath, which are mingled in a cup of tea, of which both parties partake. The great principles of this body are, the equality of all men, and the obligation of the rich to communicate of their abundance to the poor. In the year 1804, not less than nine provinces of the empire were disturbed by the machinations of these levellers; and their numbers daily increased to such a degree, that many of the more wealthy natives had become members of the association, and surrendered a part of their property to preserve the rest. Those, who resisted their influence, and refused to make such a compromise, were often secretly seized, and kept as prisoners, and even threatened with death, unless their friends should procure their release, by depositing a sum of money in a place appointed. A sect of a similar description exists in the northern provinces, under the name of Pelin-Kias, which signifies "enemies of foreign religion;" and which is founded upon discontent with the existing government, and dislike of a foreign dynasty. These associations obtain numerous partizans among the lower classes, who are often rendered desperate by their extreme indigence; and, in some districts, their members have abandoned themselves to the most daring excesses, and even to open revolt. The government have made great exertions to suppress these seditions; and it is said, that not less than 4000 persons had been capitally punished, within a very short period, on account of those practices. In 1798, one of their chiefs was proscribed by public proclamation, and a price of 10,000 piastres set upon his head; but he took refuge in the island of Java, where his principles have made great progress among the Chinese residents; but whom the dread of the European authorities has hitherto restrained from committing the excesses, to which their system has often given rise in China. By a recent edict of the Chinese government, all who were detected as members of the Thian-thee-ohe association, were condemned to have the tendons of the right foot cut across, and to have the left cheek marked with a red-hot iron: but, if farther convicted of having been engaged in any disturbance, they were sentenced to be capitally punished, by being beheaded. The people, however, in general, as long as they can easily procure their portion of rice, and a few savoury sauces, are in no temper for a revolt against their government: and hence it is the principal care of the latter to provide magazines throughout the empire, to serve as a supply in seasons of scarcity or famine.

Recapitulation of the history.

From a short recapitulation of the principal facts and events recorded in the Chinese annals, it may be seen, at one glance, that the boasted antiquity, extent, civilization, and tranquillity of China, have been too easily admitted by Europeans, and are clearly incompatible with the most authentic historical documents of that nation. From these it appears, that the greater part of the cities of China have been founded posterior to the dynasty of Tsin, about 250 years before Christ; that the empire, about 800 years before the Christian era, was composed only of the provinces of Honan, Shan-see, Pe-tche-lee, Shan-tong, and a small district in Shen-see, while the rest of the country was in the possession of barbarians; that the province of Se-tchuen was occupied by savage tribes, who were not subjected till the year 206 before Christ; that the philosopher Men-tse, who flourished 336 years before Christ, expressly declares, that the people of the kingdom of Tsoo, that is of the province of Hoo-koang, were at that time a savage race; that Quang-see was inhabited by barbarous hordes named Yue, the ancestors of the Miao-tse, who still exist in its mountainous districts, and that the lower parts were not subdued till the year 223 before Christ; that Koei-tcheoo was not reduced till the year 206 before Christ, and Yunnan not until the 7th or 8th century of the Christian era; that the kingdom of Oo in Kiang-nan was destroyed by the people of Yue and Tsoo in the year before Christ 473, but not subjected by the Chinese sovereigns till 200 years after; that Kiang-see, situated between the people of Yue and Tsoo, and the constant theatre of their wars, was not subjugated till 250 years before Christ; that Tche-kiang, inhabited by barbarous tribes, under the dominon of the Yue and Tsoo, was brought under the Chinese princes only about the same period; that Fo-kien, separated from the Chinese dominions by the kingdom of Oo, was annexed to the empire only about 200 years before Christ; that Quang-tong, inhabited by the Southern Yue, was partly subdued 214 years before Christ; but was only gradually civilized by the intercourse of the Chinese, and was finally subjugated in the year before Christ 109. The empire of China, in the earlier ages of its existence, if indeed it existed so early, must have been composed only of a few civilized clans, who lived in the midst of barbarians, and who changed their place of residence as circumstances required. This point is sufficiently established by such events as the following, recorded in the Chinese histories: namely, that in the year 1401 before Christ (1500 years after the pretended commencement of the monarchy), the Emperor Poen-keng emigrated with all his subjects to a new settlement, and assigned the example of his ancestors in vindication of the measure; that, in 1122, the empire was conquered by Voo-vang at the head of the Tcheoo, a people whom one of their succeeding sovereigns affirmed to be far from numerous; that the different tributary kingdoms, subdued by the founder of that dynasty, soon ceased to acknowledge the authority of his successors, and that at length the most powerful of them, the Tsin, introduced a new race of sovereigns 255 years before Christ; that the fourth emperor of this new dynasty, viz. Shie hoang-tee, was the first who effectually reduced these independent princes, and thus became sole master of the empire; but found such a variety of usages among these constituent parts of his dominions, that he could devise no better expedient for removing all traces of their former disunion, and compelling them to live under the same laws, than to cause all their historical records to be destroyed in the year 213 before Christ. The Chinese empire, now united for the first time, did not continue long under one head, but was soon dismembered into distinct sovereignties, till it was again established by Kao-tee, the founder of the Han dynasty, 200 years before Christ. About 220 years after the Christian era, it was again divided into three kingdoms; that of the Han, in the provinces of Se-tchuen and Shen-see; that of the Oey, in the northern part of China; and that of the Oo, in the southern regions. These three kingdoms and the reigning families were again annihilated by Voo-tee, who founded the dynasty of the western Tsin A. D. 265; while Yuen-ty, in like manner, established that of the eastern Tsin A. D. 317; but neither of these princes were long in possession of all China, and several provinces revolted during their respective reigns. After the destruction of their dynasty, A. D. 420, the whole country was thrown into a state of confusion, which gave rise to two empires, the northern and the southern. The empire of the north was almost constantly occupied by the Oey or Tartars named Topa, of whom the Yuen-Oey (or first Oey) reigned in Shan-see and Honan from A. D. 386 to 534; the Tong-Oey (or eastern Oey) reigned in Honan from A. D. 534 to 550, when they were displaced by the family of Pe-tsee, who held the throne till A. D. 578; and the Sie-Oey (or western Oey) reigned in Shen-see from A. D. 585 to 556, when they were displaced by the Heoo-tcheoo (or later Tcheoo), who prevailed till A. D. 581. The empire of the south was held from A. D. 420 to A. D. 479, by the dynasty of Song, which was followed in 479 by that of Tsee; in 502 by that of Leang; and in 557 by that of Tchin. In 581 the two empires were united by Ven-tee, founder of the Soo-ee dynasty, which was displaced in 618 by that of Tang; during the latter end of whose government, the empire was agitated by new troubles, desolated by the Tartars, named Kee-tan, and divided into so many independent sovereignties, that it was reduced within a very narrow compass, under the Heoo-oo-tay (or five later dynasties): the Heoo-lang in 907, the Heoo-tang in 923, the Heoo-tsin in 936, the Heoo-han in 947, and the Heoo-tcheoo in 951. These commotions and divisions were once more terminated in 960 by Tay-tsoo, founder of the dynasty of Song; but the two Tartar nations of Kee-tan and Kin, or Niu-tche, and the prince of Hia, still retained possession of the northern parts of China. In 1127, the Kin having destroyed the Kee-tan, the Song were obliged to remove the seat of their empire to a greater distance from these formidable neighbours, and resided in the province of Tche-kiang, till they called in the Yuen or Moguls, called by the Chinese Mong-koo, to assist them against the Kin in 1235, and were themselves overthrown by those allies in 1260, when Kublay-Khan, a descendant of the renowned Genghis-khan, became absolute sovereign of all China. Since the establishment of the Mogul dynasty, the empire has never been again divided; but has experienced two great revolutions, at the accession of the Chinese dynasty of Ming in 1368, and of the Mantchoo Tartars in 1644; and has scarcely, in any reign, been entirely free from revolts, wars, and domestic seditions. The empire of China, in short, instead of having existed as a great and united nation 3000 years before Christ, was never formed into one state till the year before Christ 220; but, being soon again dismembered, and only transiently united under successive sovereigns, has composed one sole and undivided monarchy only since the year of Christ 1279. Instead, therefore, of being regarded as a privileged country, governed from time immemorial by the same constitution, exempt from foreign conquest and intestine commotions; the only peculiarity which it possesses, in comparison with the other empires which have disappeared from the earth, is this, that, owing perhaps to its peninsular situation, at the extremity of the habitable world, and its consequent exemption from the sweep of those conquering nations, who changed the people whom they overthrew, it has preserved its manners and usages in a great measure unaltered, amidst the various revolutions and subjugations, which it has experienced.

Government.

Emperor.

The government of China bears a strong resemblance to what has been called the Patriarchal form, from which it is supposed to have originated. The emperor possesses the most unlimited authority, and can issue new laws or abrogate the old at his pleasure. He is the undisputed master of the lives of his subjects; and no sentence of death can be executed without his consent. To his revision, in like manner, every verdict in civil suits is subject, and has no force till it receive his confirmation. All his own sentences are executed without delay; and all his edicts acknowledged throughout the empire, as if they were the mandates of the Deity. He is the source of all power in his dominions; dispenses honours and offices at his will; and appoints or dismisses the mandarins of every class without controul. The princes of the blood alone, or those who bear that title, cannot be degraded or punished without a trial; but, as the sovereign has the power of nominating the judges, he always possesses the means of disposing of the life or liberty of the highest personages, who have incurred his displeasure. He has even the power of appointing his own successor to the throne, either from his own family, or from any class of his subjects; and should the person thus nominated, afterwards give evidence of being incapable or unworthy, the emperor can at once set him aside, and appoint another in his place. This unlimited power of the crown appears to be as ancient as the empire itself; and is regarded as one of the fundamental laws of the constitution.[*] It is still farther augmented and confirmed by the principle of filial respect towards the government, which is so carefully instilled into every one of the people from their birth, which arises almost to adoration, and which represents all dis-

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[*] Some degree of check upon this absoluse power of the emperor, is supposed to be provided—

1. In the ceremony of bringing offerings to deceased ancestors; on which occasion, the emperor, however implicitly obeyed during

Government.

obedience to the commands of the monarch as an unpardonable crime.

Council.

The government is composed of the emperor's council, and of the great public tribunals. The emperor's council is composed of the ministers of state taken from the Colao, or first order of mandarins, of the presidents of the supreme tribunals, of their assessors and secretaries; but is never assembled unless upon affairs of the greatest importance; and, in general cases, every thing is directed by what is called the inner court, or private council of the emperor. There are six superior tribunals at Pekin, distinguished by the general name of Leoo-poo.

Tribunals.

Lii-poo, or *tribunal of appointments to office*, supplies mandarins wherever they are required, watches over their conduct, and keeps a journal of their transactions, to be submitted to the emperor's inspection, that he may dispense promotion or punishment, according to the merits of every individual. This court is subdivided into four subordinate tribunals, the first of which selects those persons, who are supposed best qualified for supplying the offices under government, the second examines the conduct of the acting mandarins; the third affixes the seals to public acts, assigns to every mandarin the seal of his office and dignity, and inspects the seals of the different dispatches addressed to the court; and the fourth inquires into the merit of the princes of the blood, and other grandees.

2. Ho-poo, a name which signifies grand treasurer, is *the court of finance*, and has the superintendance of the whole revenues of the empire, of the emperor's treasures, domains, and expences, of pensions, salaries, and presents, of the public magazines, customs, and coining of money. It has fourteeen courts, dispersed through the empire, subservient to its numerous objects, and assisting in its immense labour.

3. Lee-poo, or *court of ceremonies*, protects the ancient customs and religious rites; directs the repairs of temples, and the conduct of the different sects; inspects the progress of the sciences, the examinations, and schools; receives, lodges, and dismisses foreign embassies, and regulates all those points of etiquette, which form so essential a part of the Chinese government. It has four subordinate tribunals engaged in its assistance.

4. Ping-poo, or *tribunal of arms*, has jurisdiction over the whole military concerns of the empire, fortresses, arsenals, manufactories of arms, the examination and appointment of officers; and yet it is composed entirely, as well as the four tribunals in its service, of civil mandarins.

5. Hong-poo, or *tribunal of justice*, directs every thing relating to the detection and punishment of crimes; and has fourteen tribunals under its inspection, and employed in its service.

6. Kong-poo, or *the tribunal of public works*, has the care of the palaces, public halls, monuments, temples, canals, bridges, high ways, mines, manufactories, and every thing relating to foreign and inland navigation. It has four inferior courts employed in expediting its labours.

Each of these six supreme tribunals has two presidents, one of whom must be a Tartar by birth; and 24 counsellors or assessors, one half of whom are Tartars, and the other half Chinese. In order to check these various tribunals, it is enacted, that none of them shall have absolute authority, even in its own department, and its decisions can have no effect, without the concurrence of the other courts.

Next to these six tribunals is that of the princes, which is named Tsong-gin-foo, and which regulates every thing relating to the princes of the blood; keeps a register of all the children of the imperial family, with their future honours and appointments, as they are bestowed in the course of their lives, judges of their conduct, and subjects them to punishment; and presides likewise over the eunuchs, slaves, and officers of the palace.

Censors.

There is also a very important tribunal, called Too-tche-yuen, or *tribunal of public censors*, who have the inspection of the whole nation, of the emperor himself, of the supreme tribunals, of the different orders of mandarins, and of every class of citizens. Along with the chiefs of the several tribunals, they have the privilege of addressing remonstrances to the emperor himself; but it would be a capital offence in any of them to fail in shewing due respect to the person of the sovereign; and even the emperor's forgiveness could not save him from the vengeance of the laws. This tribunal sends an inspector general, called Ko-tao, to each of the six supreme tribunals, who take no part in the deliberations of these courts, but merely observes all that passes; and, without even communicating with his colleagues, renders an account in secret to the emperor of all that he has noticed. The same tribunal likewise sends visitors, every three years, to each of the provinces; and these officers, as soon as they reach their respective destinations, are superior to the governors and mandarins, whose administrations they inspect, but whose oppressions they seldom denounce, unless when they are very flagrant and extensive. They dispatch even secret visitors through all the provinces; and their enquiries are dreaded by all classes in the state. They have the power of nominating the inspector of the imperial canal, which is one of the most lucrative offices under government; and, though all the members of this tribunal of censors are only of the seventh order of mandarins, they possess, from their office, the greatest authority, and command the utmost respect.

While it is by means of the viceroys and mandarins, that the emperor governs and reigns, it is by means of these different tribunals, that he knows and sees, as it were, every thing that is transacted throughout his immense empire. As the grandees and mandarins, in their different stations, have a right to a part of that reverence, which is due to the sovereign from whom they derive their authority; he is careful, both for his own safety and the welfare of his subjects, that these officers be prevented from abusing their power, or acquiring too much influence over the people. He, therefore, changes them regularly every three years; obliges them to present themselves before him, both when they depart for their

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his life, is assured, that his memory will be annually brought into public view after his death, and be pronounced with reverence and affection, or loaded with contempt and execrations, according to his conduct upon the throne.

2. In the tribunal of censors, which will afterwards be described, who have the power of remonstrating against every illegal and unworthy act of the emperor. And,

3. In the historiographers of the empire, whose office it is not only to give a faithful detail of public events; but to narrate even the private actions of the emperor, to collect his sentiments, and to record his memorable sayings. These documents are all lodged in a large chest, which stands in the court of one of the supreme tribunals, and which is supposed not to be opened till after the decease of the reigning monarch, or, should any thing unfavourable to his character be inserted in it, it remains shut up till after the lapse of several generations, or even to the expiration of the existing dynasty, that then these public recorders may not be influenced in their office by either fear or flattery, of the prince or his descendants.

respective stations, and when they return; and, in order to retain a stronger hold upon their allegiance, causes their children to be educated in the imperial college of Pekin. An ancient custom of the empire also requires, that they shall become their own accusers, and make confession of their faults; but, as it may well be supposed, that they would be inclined to palliate and conceal whatever affected their character, in order that the emperor may know the truth, he dispatches the secret inspectors from the tribunal of censors; and according to the information received from them, after personal enquiry in the district of the mandarins under examination, the emperor punishes or rewards; and, that these proceedings may have their full effect for the restraint or encouragement of others, the names of those, who have been censured or approved, cashiered or promoted, are inserted in the court gazette. This absolute sovereign, in short, always vigilant, distrustful, and severe, looks into every quarter; exalts or degrades his grandees in succession; and it is upon the instability of offices, and the desire of obtaining them, that he rests his own security, and that of his dominions. The policy of the Chinese emperor is to make every thing depend upon himself; to change the persons, who are in office at his pleasure; to keep up a constant mutual jealousy among the mandarins; to take care, that no one becomes too wealthy and powerful; and to be continually dividing anew the immense riches and authority, of which he has the entire disposal.

Corruption.

This plan, however, of governing the people as a family, which is the precept of Confucius, is more beautiful in theory, than practicable in reality; and, as the sovereign is unable to see every thing with his own eye, all his superintendance and vigilance are rendered unavailing, by the want of integrity in his deputies. These imperial commissaries, whose function is so formidable, who possess the authority of the emperor, who examine the conduct of the great officers, and who have the power of accusing and deposing in their hands, seldom execute their orders with due fidelity. As soon as they arrive in a province, all the mandarins hasten to wait upon them, to anticipate their wishes, and to beg their acceptance of presents. All the mandarins, entrusted with any commission from the court, are nominated by the ministry; and, as soon as their term in office is expired, they make presents to the ministers, the princes of the blood, the presidents and assessors of the tribunals, and then sit down with the rest of their gains, in full security of no inquiry being made into their administration. All complaints must pass through the principal officers, before they can reach the emperor; and these persons are all so united in interest, that no remonstrance reaches the throne without their full consent. This love of presents has always prevailed in China among the mandarins; and all the attempts of the emperors to check the practice have proved ineffectual. The two last emperors, Yong tching and Kien-long, increased the salaries of the governors of cities and provinces, and expressly prohibited them from accepting any gift. But both the persons who wish to receive, and those who find it their interest to offer, a present, are at no loss in accomplishing their object; and a valuable commodity sold for a trifle fully answers the purpose. These governors, in order to procure the means of making the rich presents, which are necessary to preserve their places, find themselves constrained to make exactions from those who depend upon them, to commit a multitude of extortions, and to shut their eyes to the abuses of their subalterns. Thus the orders of the emperor become entirely null; and the boasted reciprocal vigilance of the mandarins, is converted into a mutual league, to secure themselves from all inquiry. It does, indeed, occasionally happen, that a guilty viceroy is thrown into prison, deprived of his office, and unjust acquisitions; but those examples only suspend the pillage for a short time; and those very disgraced mandarins are soon after admitted again to favour, and sent to other provinces to repair their fortunes. "The emperor," says M. De Guignes, "makes use of his grandees, as a sponge to suck up the riches of his subjects. When the sponge is full, he squeezes it, and sends it elsewhere to be filled anew. I repeat it: The Chinese have a wonderful love of money. They embrace with avidity every possible method of procuring it; and it is very rarely that they fail in finding an opportunity." In confirmation of this remark, the same author relates various instances of *sponging* which came within his own knowledge; of which the following may be given as a specimen: "The mandarin, of whom Lord Macartney complains in his embassy, had been viceroy of Quang-ton and Quang-see. The emperor, upon nominating him to that office, observed, 'I place you in a city where there are many European curiosities, but from which nothing is ever sent to me.' It may be presumed, that the viceroy, understanding these words, when once he had reached his province, forgot neither the emperor nor himself. The Chinese, who had occasion to ask favours of him, could not procure admission to his house, under less than a present of 15,000 or 20,000 piastres, (L. 4500); and one private individual was unable to obtain permission to see him, because all that he could afford, did not amount to 10,000 piastres, (L. 2250); but the secretaries profited by the offering, and promised to speak to their master in his favour." Another instance will show how the government is deceived in the most important matters. "The Tsong-too of Canton caused a number of gallies to be built in 1794, to pursue the pirates who infested the coasts; and he wrote to Pekin, that the preparation was completed. The emperor replied, 'your predecessor assured me that there were no longer any pirates existing, and the expence of the armament must be placed to your own account.' What happened? The gallies remained there; the Tsong-too paid as he thought proper, and the pirates are still in existence. The fact is, that the preceding viceroy had actually caused gallies to be armed; but the mandarins, instead of attacking the robbers, preferred carrying on a traffic in opium; and wrote, at their return, that the object was accomplished. I have myself seen forty heads sent from Hay-nan, as the heads of pirates: a pretty evident proof, without doubt, of the expedition having been undertaken. By no means; the greater part of these heads belonged to dead bodies dug out of their graves."

Oppression.

With the greatest possible show of paternal regard for the good of the people, they are miserably neglected in the points most essential to their welfare; and in the times of famine, while the gazettes are full of the emperor's expressions of sympathy for his children, and of the measures adopted for the relief of the distressed districts, so many delays are practised, that the calamity is generally at an end before the imperial succour arrives. Sometimes these seasons of scarcity give rise to violent commotions, when the starving multitudes not only rob and murder, but actually devour each other. Then, indeed, the severity of the government is displayed, and the supreme authorities coldly calculate the necessity of putting to death a certain number of individuals, in order to restore tranquillity. "The Chinese, in short," observes the same intelligent writer, (M. De Guignes,) to whom we have already so often referred, "are treated in a most rigorous manner; and if they do not always complain, it is because they would gain little by doing so."—"I have lived a long time," he adds, "in China. I have traversed that vast empire in all its extent. I have every where seen the strong oppress the weak, and every man, who possessed any portion of authority, employ it to harass, to burden, to crush the people."

Causes of stability.

Such is the mode, in which this government, which has been so highly extolled, and whose stability has been held up as a proof of its perfection, is found to be generally administered; and how, then, are we to account for its duration and tranquillity? It is still a matter of doubt, and sufficiently open to dispute, whether the peace and permanency of the Chinese government is to be attributed to its having been originally adapted to the genius and habits of the people, or to its having completely subdued and moulded their dispositions and manners to its views and maxims. Opposite sides of this question seem to be adopted by the most recent and intelligent writers on the subject, Mr Barrow and M. De Guignes; the former, conceiving the nature of the Chinese government to have given its present impression to the character of the subjects; while the latter rather inclines to the opinion, that the government itself has arisen out of the genius of the people themselves, and that any change in the system might be attended with fatal effects. There is, perhaps, a mutual reaction between the government and the people; and while the former may have gradually been framed according to the state and temperament of the latter, it may be supposed to have become active in its turn, and to have produced, by a long process, a degree of servility in the nation, which cannot be imagined to have otherwise existed.

Filial piety.

The basis of the whole system is, the natural and unlimited authority, which a parent is understood to possess over his offspring, as long as they live; a maxim which has been industriously inculcated for ages upon the natives of China, and which is now completely interwoven with all their earliest feelings and principles. The emperor is regarded as the common father of his people, and is accordingly invested with all that absolute dominion which a parent is considered, in that country, as necessarily possessing over his family. He is not only placed above all earthly controul, but is supposed also to be of more than mortal descent. Hence he not merely takes the title of "the Great Father," but likewise styles himself "the Son of Heaven," and "the sole Ruler of the World." He himself, too, gives the example of that submissive respect, which, as the general parent, he claims from his subjects; and, at the commencement of every new year, he prostrates himself in the presence of the empress-dowager, before he receives the prostrations of his officers and attendants. The same principle pervades all the branches of authority; and the governor of a province, a city, or any other department, is considered as the father of all, who are under his immediate jurisdiction. In practice, however, as has been shewn, this plausible theory is sadly defective; and the parental affection and care of the governor has rather the appearance of cruelty and oppression; while the filial duty of the governed is little better than fear, deceit, and disaffection. The very conduct of the monarch gives sufficient proof, that it is an artificial policy, rather than an arrangement of nature, by which he rules; for, in direct opposition to that confidence and delight, with which a father should appear in the midst of his family, it is the first and great maxim of state, that he should shew himself as rarely as possible to his people in public, and then only, when he is invested with the utmost degree of magnificence and splendour.

Equalization of honours.

Another cause of the permanency and solidity of the Chinese government, may be found in the circumstance of the first honours in the state being open to the lowest of the people; which satisfies and soothes the public mind, and induces the subjects to bear with greater patience that insolence of office and stretch of power, which they themselves, their friends, or their children, may have the prospect of exercising. The very act of choosing a magistrate from the lower class, seems to give the people a higher idea of the wisdom of government, and to satisfy them that affairs will be better managed by such persons, than by any other. They are deceived in their expectation, while they still persist in cherishing it. The more obscure that the condition of a Chinese mandarin has originally been, the more he strives to make it be forgotten, by treating with contempt such as were once his equals. He imagines, that the figure of a bird or a tiger embroidered on the front or the back of his coat, bestows every species of worth; and he continues to solicit for places, till he becomes governor of a city, governor of a province, and finally reaches the dignity of Tsong-too; when he begins to abuse the authority with which he has been entrusted, resumes all the native meanness of his original education, pillages, oppresses, and grinds the people; till the emperor, acquainted with his excesses, cashiers, banishes, and remits him to the crowd, from which he had by chance been drawn. Still, however, his very misconduct and dismissal open the way to another of the people; and they are pleased with a government, which is thus every day formed from their own body.

Subordinate causes.

The following causes have also been assigned, as perhaps contributing their share of influence to the support of the constitution. 1. The low state of civilization among the Chinese, which prevents their acquisition of enlarged views of political freedom: 2. The natural barriers of the country excluding foreign enemies, and the extreme caution of the government in admitting strangers into the empire: 3. The difficulty of making progress in the language, which keeps the body of the people in ignorance: 4. The complete religious toleration which is exercised, (with only one exception, that of Christianity,) neither prohibiting the people from embracing any sect that they choose, nor compelling them to contribute to the support of one which they dislike: and, 5. The means which are employed to inculcate sober habits, and to render individuals reserved, formal, suspicious, and unsocial, which prevents all haranguing and caballing, all conferences about political right or wrong, and all plans of opposition to the will of the government.

But, leaving all farther speculations as to the means and contrivances, by which this enormous and apparently unwieldy machine of the Chinese government is kept together, and enabled to go on, let us attend to the constituent parts, which have been thus so long and so solidly bound together.

The court.

The court, or officers of state, and other attendants upon the person of the emperor in public, are incalculably numerous, and inconceivably magnificent. The general appearance of the whole, on great occasions, all robed in the richest silks, embroidered with the most brilliant colours, and tissued with gold and silver, arranging and conducting themselves in their respective places with the utmost order, silence, and solemnity, and performing every function with as much reverence and awe, as if they were celebrating some religious mystery, is said to have altogether a very striking and imposing effect. But it is only in the aggregate, when thus assembled in public exhibition, that they have any show of dignity. In private, they are extremely insignificant; and, like mere hired actors in a spectacle, they shrink into very paltry personages, when they are not upon the stage. Every officer thus attending upon court, when his public duty is performed, retires to a sufficiently miserable and solitary cell, in the environs of the palace; takes his food alone upon a square table, crowded with bowls of rice and different stews, without table linen, or napkins, knife, fork, or spoon; but with a pair of small sticks, or quills of a porcupine, throws the food into his mouth, after the manner of the common people; and, having finished his lonely meal, generally lays himself down to sleep, without ever associating with his fellow attendants in any thing like conversation or conviviality, which would infallibly excite the strongest suspicions of the government.

Court days. Their public and pompous displays are confined to certain fixed festivals, such as the anniversary of the emperor's birth-day, the commencement of the new year, the ceremonial of holding the plough, the reception of foreign embassies, &c. It is only on such occasions, that the emperor appears in public; and even then he only shews himself within the precincts of the palace, from which the populace are entirely excluded. Of these exhibitions, the emperor's birth-day is the most splendid, as at that time all the principal officers of government, civil and military, all the Tartar princes and tributary chiefs, are expected to attend. The following description of this festival, by Lord Macartney, will convey to our readers a better idea of the splendour and ceremonies of this eastern court, than any abridged view that we could attempt to give. "The 17th of September, being the emperor's birth-day, we set out for the court at three o'clock in the morning."—"We reposed ourselves about two hours in a large saloon, at the entrance of the palace inclosure, where fruit, tea, warm milk, and other refreshments were brought to us. At last, notice was given, that the festival was going to begin; and we immediately descended into the garden, where we found all the great men and mandarins in their robes of state, drawn up before the imperial pavilion. The emperor did not show himself, but remained concealed behind a screen, from whence, I presume, he could see and enjoy the ceremonies, without inconvenience or interruption. All eyes were turned to the place where his majesty was imagined to be enthroned, and seemed to express an impatience to begin the devotions of the day. Slow solemn music, muffled drums, and deep-toned bells were heard at a distance. On a sudden the sounds ceased, and all was still. Again they were renewed, and then intermitted, with short pauses; during which, several persons passed backwards and forwards in the *proscenium*, or foreground of the tent, as if engaged in preparing some *grand coup de theatre*. At length the great band, both vocal and instrumental, struck up with all their powers of harmony; and instantly the whole court fell flat upon their faces before this invisible Nebuchadnezzar."—"The music might be considered as a sort of birth-day ode, or state anthem, the burthen of which was, 'Bow down your heads, all ye dwellers upon the earth; bow down your heads before the great Kien-long, the great Kien-long.' And then all the dwellers upon China-earth there present, except ourselves, bowed down their heads, and prostrated themselves upon the ground, at every renewal of the chorus. Indeed, in no religion, either ancient or modern, has the divinity ever been addressed, I believe, with stronger exterior marks of worship and adoration, than were this morning paid to the phantom of his Chinese majesty. Such is the mode of celebrating the emperor's anniversary festival, according to the court ritual. We saw nothing of him the whole day, nor did any of his ministers, I imagine, approach him; for they all seemed to retire at the same moment that we did."

Eunuchs of the palace. At the Tartar conquest, all the eunuchs, to the number of 6000, were deprived of all offices of trust and importance; but they are still extremely numerous about the court, chiefly as keepers of the females, and as superintendants of the gardens, buildings, and other works connected with the palaces. The *rasibus*, as they are called, who are deprived of every trace of manhood, are admitted into the interior of the palace; and their chief business is to attend upon the ladies, whom they emulate in every female art of painting the face, and studying their dress. The greatest favourite among the eunuchs waits upon the emperor, and sleeps in the same room; and the power of this person in prejudicing his master is often felt by the first officers of state. These creatures, in general, are described as addicted to all the vices which distinguish the tribe in other places; as particularly insolent, rapacious, and spiteful in the extreme; as detested and dreaded by all the court officers, and even by the princes of the blood; and as requiring to have their good will secured by frequent and costly presents.

Emperor's household. The only companions of the emperor, in his leisure hours, are the women and these eunuchs. His wives are distributed into three classes. The first class consists only of one, who has the rank of empress; the second, of two queens, and their attendants; and the third, of six queens, with their train. To these are added a hundred ladies, usually called the emperor's concubines, but forming an equally legal part of his establishment; and men of the first rank account themselves highly honoured, when their daughters are admitted into this number. Their children are all considered as branches of the imperial family; but the male issue of the first empress is generally regarded as the heir apparent to the throne, though this depends, as has been mentioned, upon the will in the emperor, who has the sole right of nominating his successor, and of choosing him out of any class or family in the empire. The daughters of the sovereign are generally given in marriage to Tartar princes and officers, and rarely to a Chinese husband. The emperor's women are doomed to reside for ever within the walls of the palace; and, after his death, they are immured for life in a separate building, called the palace of chastity.

Princes of the blood. The princes of the blood, or descendants of the imperial family, are the only persons in China who can be said to possess any portion of hereditary nobility; and even their privileges are extremely few and restricted. Those who are descended in a direct line from the reigning family, have their names and date of their birth registered in a yellow book; and have the privilege of wearing a yellow girdle; but those who are only of collateral descent, that is, from the uncles or brothers of the founder of the dynasty, have their names enrolled in a red book, and the right of wearing a red girdle. Even the princes of the blood, however, beyond the third generation, scarcely possess any distinction whatever, and gradually sink into the common mass of subjects, unless they have talents and application, to attain those offices, to which honours are attached. They have the privilege of being tried only by their peers, called the tribunal of

Want of nobles.

princes, which takes cognizance of no other rank; and they may procure exemption from any corporal punishment by a fine. Their persons, also, are in some degree rendered sacred; and should any one insult a prince of the blood, when decorated with his yellow girdle, he is punished with death; but, if the prince had omitted to wear his girdle at the time of the assault, it is then considered by them as a case only between one citizen and another. Those of them, who hold no offices which give them rank and revenue, are entitled merely to draw the full pay of a soldier in the Tartar bands; and receive a present from the emperor of 100 taels, about 30 guineas sterling, when they marry. At their death, also, the same sum is allowed to defray their funeral expences; and the emperor occasionally relieves their widows and families. Princes and princesses of the inferior classes must petition the emperor for permission to marry; but princes of the direct line may omit this form, unless when they wish to be connected with any of the Tartar families. The family of Confucius, also, is accounted noble; and his descendants in the direct line enjoy a title of honour. All those, likewise, who have held the post of a mandarin, or obtained any literary degrees, continue to be accounted noble, even after they have ceased to hold office. A title of honour may be continued in a family, as a mark of the sovereign's favour, but it confers no power, privilege, or emolument, and very soon wears out. With these exceptions, it may be said that there is no hereditary rank in China. All dignities are merely personal, and attached to the holding of some office. The sons of the highest mandarins derive no authority or title from the rank of their father; and, if they have not the requisite talents and acquirements to procure office for themselves, they fall back into the common mass. As the possessions of their father, also, according to the laws of the empire, are equally divided among all his sons, the riches of the greatest families diminish in proportion to the number of heirs, and thus they soon sink down from their former splendour. Even property and character have no weight in China; but, except the morals be notoriously bad, learning and abilities, of a particular description, are the only, and almost the sure, passports to the higher offices and honours.

Court dress. The emperor and his children are clothed in robes of a bright yellow colour; while all the other branches of the royal family, and princes of the empire, wear, like the mandarins, violet-coloured garments. The emperor, his sons, and the princes of the first rank, are also distinguished, by having the figures of dragons with five claws, called Long, embroidered on their vestments; while princes of the second rank have the same dragons, with four claws; and those of the third rank, as well as the mandarins, have, instead of dragons, a species of serpent, with four claws, named Mang. The button of ceremony on the head dress of the emperor, consists of three dragons of gold, placed one above the other, with four pearls on each, one pearl between each, and one large pearl surrounding the whole. His upper robe has four circles, embroidered with the figure of a dragon, one on each shoulder, a third on his breast, and a fourth on his back. His necklace, which, in his case alone, can be composed of pearls, consists of 112 pearls, and other ornaments of rubies, sapphires, and amber. His girdle is of a bright yellow, with four circles of gold, adorned with rubies, sapphires, and pearls.

The oldest son of the emperor, named Hoang-tay-tse, has a similar button to that of the emperor, but composed of 13 instead of 16 pearls; a necklace of coral, with ornaments of sapphires; and a bright yellow girdle, with four circles of gold, adorned with azure stones and pearls.

The bonnets of the sovereign and the heir apparent have also a figure of the idol Fo surrounded with pearls.

The other sons of the emperor, called Hoang-tse, are adorned like the eldest, except that they have fewer pearls in their ornaments, and a ruby instead of the figure of Fo. The princes of the different ranks are, in like manner, distinguished, chiefly by the number of pearls in the front of their bonnets, and the colours of their necklaces.

Classes of subjects. The great body of subjects is divided into seven classes, the mandarins, the military, the literati, the bonzes, the husbandmen, the artizans, and the merchants.

Mandarins. The mandarins, whether civil or military, are the most respected; and they are chiefly taken from the three last classes. All the Chinese aspire to this rank, both as investing them with a portion of authority, and also as increasing their power of acquiring wealth. As soon as a Chinese possesses a little money, he enters into trade; and when he has become rich, he generally procures, by his wealth, the office of an inferior mandarin, that he may enjoy his possessions with greater security.

Literati. The literati are generally the candidates for places, without which, their attainments are not much respected. Their names are enrolled into the lists of the tribunal Lii-poo, which has the business of nominating mandarins, and of informing the emperor when vacancies occur.

Bonzes. The bonzes are very numerous; but their exact amount is very differently reported by writers on China. De Guignes calculates their number at one million; and observes, that they are generally in possession of lands, farms, and houses.

Husbandmen. The husbandmen are the most favoured by government; but, at the same time, the least wealthy.

Artizans. The artizans are not bound, as has been supposed, to follow the employment of their forefathers; and they generally enter into commerce, as soon as they can find the means.

Merchants. The traders are the least respectable, especially those who traffic with foreign nations.

Players and prostitutes. Players, and those who engage in the business of prostitution, are the only persons accounted directly infamous, and inadmissible as candidates for the office of a mandarin; and in the case of the former, an enactment of the Emperor Kien-long requires three generations to wipe off the stain.

The conductors of the imperial barges, who are called Kan-kia, are also of bad repute; because the persons, employed in dragging these vessels, are commonly Chinese criminals, who would otherwise have been punished with banishment.

Mandarins. The class of mandarins, with all their authority, are under considerable restrictions, to preclude the possibility of their ever becoming dangerous to the supreme power. They are changed every three years from one station to another, are incapable of holding any civil office in the province where they were born, and cannot be stationed nearer to it than 50 leagues, till they have attained the age of 60 years. They cannot marry in the province or city where they govern; and must all remove from their posts at the death of a father, mother, grandfather, or grandmother. When a mandarin obtains a superior office in a province, where one of his relations is employed, the latter is obliged to inform the tribunals at Pekin, who remove him to another place. The father, the son, the uncle, and the grandson, cannot be united in the same tribunal. If the perpetrator of a robbery or murder cannot be discovered, the mandarin of the district where the crime was committed is deprived of his office. A mandarin cannot be brought to justice as long as he is invested with authority, because he then represents the emperor; but he must be cashiered, before he can be subjected to trial and punishment. A mandarin has full power in his district; but they are all subject to the authority of those who occupy a higher degree, and the superior orders are responsible for the conduct of the inferior. Both civil and military mandarins are payed from the revenues of the province, in the different parts of which they are employed; but their salaries are barely competent to defray the expences of their office, which is one cause of their general inclination to pillage the people. The highest does not amount to 1000 crowns; but, in spite of all the checks which the laws have placed upon their conduct, they easily find means not only to supply their wants, but also to acquire wealth. It is so rare to see one of them leave his employment without having become rich, that a disinterested mandarin is regarded by the Chinese as a phenomenon; and it is a common proverb in the country, that the emperor lets loose just as many wolves and robbers as he creates mandarins. Notwithstanding this general opinion of their character, and the circumstance of their being all taken chiefly from the lower classes of citizens, the people obey them with great reverence. They are saluted with the appellations of Lao-ye, or lord; Ta-lao-ye, or great lord; Ta-gin, or great man. Every one, who is not himself invested with an office, or honoured by a literary degree, must bend the knee when he addresses a mandarin; and every person, who meets him on the road, must stand with his head erect, and his arms by his side, till he has passed. This awe and servility is kept up by the great show which they attempt to make, and by the severe punishments which would be inflicted, upon the least symptom of disrespect. They never appear in their districts without a considerable retinue, composed of all who belong to their tribunal, consisting frequently of more than 100 persons. The procession is opened by two men, armed with long flat bamboos, for inflicting the bastonade, who call out at intervals to intimate the approach of the mandarin, and who are followed by two drummers, beating on large copper kettles. After them walks a company of executioners, provided with chains, whips, and sabres; and next the bearers of parasols, standards, and other insignia of authority. A few soldiers on horseback then appear, preceding the palanquin of the magistrate, which is borne by four men, and surrounded by his principal domestics. A few more soldiers, mingled with persons carrying various articles, which are required in the service of the great men, terminate the train. But all this apparent pomp, which consists chiefly in the number of attendants, discovers, upon a nearer inspection, very little magnificence, neatness, order, or wealth. Excepting those, who are stationed nearest to the person of the mandarin, the persons who compose the retinue are poorly clothed; the parasols are often in tatters; and whenever the mandarin leaves his palanquin, the cavaliers mix with the lowest soldiers, executioners, and other menials, and may all be seen together upon the ground engaged at different games.

Dress of the mandarins.

All the mandarins wear robes of a violet colour, and are alone entitled to use golden embroidery. Their different orders and degrees are minutely distinguished by particular kinds of dress; and their wives also are habited in a manner conformable to the rank of their husbands. They are characterised at one glance by the figure upon the front and back of their robe, by the colour and form of the girdle, and by the button upon the top of their bonnets, of which they have two kinds, the bonnet of ceremony, and one for ordinary use. There is a difference also between their winter and summer dress: the former of which, ornamented with furs, is put on about the middle of October, and laid aside about the middle of April. The chief mandarins are distinguished farther by having eight bearers of their palanquins, while the inferior orders have only four, and private persons never more than two.

There are nine orders of mandarins, who are distinguished, besides other less prominent marks, as follows:—

1. By a ruby of *transparent red* on their bonnet; by the figure of a Ho, or *pelican*, on the front and back of their robe; and by four stones of *agate*, with rubies on their girdle. The military officers of the same order, having the same decorations, but instead of the pelican, have the figure of Ky-lin, *a fabulous animal.*

2. By a ruby of *opaque red*, the figure of a Kin-kee, or *golden hen*, and four wrought squares of gold, with rubies on the girdle: The military officers of the same order, have the figure of a Sie, or *lion.*

3. By a sapphire of *transparent blue*, the figure of a Kong-tsio, or *peacock*, and four squares wrought with gold on the girdle: The military officers of the same order have the figure of a Pao, or *panther, with round spots.*

4. By a stone of *opaque blue*, the figure of a Yen, or *crane*, and four squares of wrought gold, with a silver button on the girdle: The military officers of the same order have the figure of a Hoo, or *tiger.*

5. By a rock crystal of *transparent white*, the figure of a Pe-hien, *white-pheasant*, and four squares of plain gold, with a silver button on the girdle: The military officers of the same order have the figure of a Hiong, *bear.*

6. By a marine shell of *opaque white*, the figure of a Lu-su, *stork*, and four round plates of shell, with a button of silver on the girdle: The military officers of the same order have the figure of a Pien, or *small tiger.*

7. By a *small crystal* and button of plain gold, the figure of a Kee-she, *partridge*, and four round plates of silver upon the girdle: The military officers of the same order have the figure of a See, *rhinoceros.*

8. By a button *of wrought gold*, surmounted by another of the same kind, the figure of a Ngan-shun, a *quail*, and four plates of rams-horn, with a silver button upon the girdle: The military officers of the same order, have the figure of the 7th order, the See, or *rhinoceros.*

9. By a button *of wrought gold*, surmounted by another of silver, the figure of a Tsio, or *sparrow*, and four plates of black horn, with a silver button upon the girdle: The military officers of the same order, have the figure of a Hay-ma, *sea-horse.*

Next to the mandarins, the persons who have obtained degrees in the civil or military examinations, and who are the candidates for vacancies in these orders, have also a distinguishing mark according to their progress, and which consists chiefly in a button of wrought gold, a button of wrought silver, or a button of plain silver.

Civil mandarins.

Of the civil mandarins, the chief officers, who govern the empire, are the

1. Ttsong-too, whose jurisdiction extends over one or two provinces; and of whom there are reckoned only eleven in the empire.

2. Foo-yuen, or governor of a province.

3. Poo-tching-sse, or chief treasurer, and civil judge.

4. Ho-poo, or collector of the customs, an office peculiar to the two provinces of Quang-ton and Fokien.

These four mandarins are taken always from the members of some of the supreme tribunals at Pekin.

5. Ngan-sha-sse, chief criminal judge.

6. Tao-ye, or intendant of two cities of the first order.

7. Tching-tchoo-kao, or president of examinations, who is always sent from Pekin.

8. Hio-yuen, or inspector of schools, also sent from Pekin.

9. Yen-yuen, or intendant of the salt-works.

10. Y-tchooen-tao, or intendant of ports, the shipping, and boats.

11. Pin-pee-tao, or inspector of troops.

12. Tun-tiao, or intendant of the high-ways.

13. Ho-tao, or inspector of rivers.

14. Hay-tao, or inspector of the sea-coasts.

15. Tchee-foo, governor of a city of the first order.

16. Tchee-tcheoo, governor of a city of the second order.

17. Tchee-hien, a governor of a city of the third order.

18. Eul-foo, or sub-governor.

19. Eul-ya, assessors or assistants to the governors.

20. Nan-hay, or head of police, with his assistants.

21. Shooy-ko-tse, receiver of the duties from merchants shops.

22. Sse-yu, keeper of prisons.

23. Shooy-ta-she, chief of the custom-house.

24. Koo-ta-she, inspector of the magazines.

25. Y-tcheng, inspector of the posts in the city.

26. Hio-tcheng, inspector of the schools in a city.

Each of these mandarins has a council or tribunal, under his command, called Ya-men, or assistants. The smaller towns and villages have, in like manner, their respective magistrates; and the whole number of civil mandarins in the empire are calculated by different writers at different amounts, of which the average is about 10,000.

Military mandarins.

There are at Pekin five military tribunals, called Oofoo, which comprehend the five classes, into which all the military mandarins are arranged.

1. Heoo-foo, or rear-guard.

2. Tso-foo, or left-wing.

3. Yeoo-foo, or right-wing.

4. Tchong-foo, or centre-corps.

5. Tsien-foo, or advanced guard.

Each of these classes have at their head a president, and two assessors or assistants, taken always from the most distinguished officers; and they are all subject to a supreme tribunal named Jong-tching-foo, whose president is one of the highest grandees of the empire, and to whom are attached a civil mandarin as colleague, and two assistants. This tribunal watches over all the officers and soldiers of the court, but, in matters of importance, is itself subject to the civil tribunal called Ping-poo.

The names of the Tartar military mandarins, and the number of men under the immediate command of each, are,

Tsiang-kiun, equivalent to a general; 3000.
Too-tong, to a lieutenant-general; 1000.
Koo-shan, to colonels.
Tsang-ling, to lieutenant-colonels of cavalry.
Fang-yu, to captains.
Hiao-kee-kiao, to lieutenants.

Chinese military mandarins.

Tee-too, commander of the troops of a province; 4000.
Tchong-kiun, his lieutenant-general, whose station is in the centre of the army; 3000.
Tsong-ping, generals; 3000.
Foo-tsiang, marshals of the camp.
Tsang-tsiang, commander of brigades.
Yeoo-kee, colonels.
Sheoo-pey, lieutenant-colonels.
Tsien-tsong, captains.
Pa-tsong, lieutenants.
Pe-tsong, centurions, or commanders of a hundred men.

The number of military mandarins, including the centurions, is between fifteen and twenty thousand; but they are greatly inferior in influence to the civil officers.

RELIGION.

It is scarcely possible to give a distinct account of the religion of China, and to class its numerous superstitions under appropriate heads. It is indeed pretended by some writers (Father Amiot) on the subject, that the ancient religious system of the Chinese has continued unchanged amidst all the corruptions, which have been grafted upon it during many successive ages; that this system is found to agree, in its most essential parts, with that of the Israelites, before the giving of the law by Moses; and that it may be traced back, by means of regular traditions, even to the renewal of the human race, by the grandsons of Noah. It is affirmed, on the contrary, by an intelligent traveller of our own country, (Mr Barrow) that the primitive religion of China no longer exists, or exists only in a most corrupted state; that there is at present no national, nor scarcely any state, religion, in the empire; and that the articles of faith are as various as the modes of worship. All that we can attempt, therefore, amidst these discordant opinions, is to present our readers with a short view, first of the principal religious systems, which have been introduced into China at different periods, as far as can be ascertained from their own historical records; and next, of their present religious observances, as far as these have been described by later travellers in that country.

All accounts of the religious opinions and ceremonies of the Chinese, previous to the time of Confucius, are mixed with fable, and full of uncertainty. Indeed, as their best existing historical documents must be regarded as his productions, and are at least ascribed chiefly to his pen, by the Chinese themselves, none of the allusions to religious practices, which are to be found in the earliest periods of their history, can be considered as resting upon any authority, more ancient than his. But as the Chinese affirm the greater portion of their canonical book Shoo-king to have been composed, long before the age of Confucius, and to have only been restored by his labours; we may proceed upon this idea, and consider the tenets expressed in this work, as the ancient religion of China.

Primitive religion.

In this view of the subject, their primitive creed seems to have contained the general doctrines of theism with regard to the Supreme Being, whom they worshipped under various names, such as Tien or Kien, *heaven*, Shang-tien, *supreme heaven*, Shang-tee, *supreme Lord*, and Hoan-shang-tee, *sovereign and supreme Lord*. This Supreme Being they regarded as possessed of all natural and moral perfections, as exercising a minute and judicial providence over mankind, as rewarding virtue and punishing vice, even in this life, as sending calamities to warn and reform the offender, and as ready to relent, and pardon him upon his repentance. The first worship instituted in honour of the Shang-tee, consisted in prayers accompanied with sacrifices or gifts, offered upon some natural eminence, or artificial mount, or merely in the open fields, upon an altar called *tan*, composed of a round heap of earth, or of a quantity of stones thrown together in a round form. At a very early period, however, of their history, we find them associating with the Shang-tee, or Supreme Being, a multitude of tutelary spirits as objects of worship, under the name of Shin, or Kooey-shin. Around the Tan, or supreme altar, was drawn a double fence called Kiao, constructed with turf and branches of trees; and in the space, which was thus inclosed, two smaller altars were erected, one on each side of the Tan; and, upon these, immediately after the sacrifice offered to the Tien, they sacrificed also to the Shin, that is, to the superior spirits of every rank, and to their virtuous deceased ancestors, imploring their protection and mediation with the Shang-tee. Their code of morals, at this period, was comprehended in two virtues, Jin and Y; the first of which expressed piety to God and to parents, or good will to mankind in general; and the second signified equity or justice. The sovereign alone, who was considered as the high priest of the empire, had the privilege of sacrificing to the Tien; but any other person might supply his place in making offerings to the Shin. In the earlier ages of the empire, when its boundaries were not very extensive, one mountain was sufficient for the performance of these rites; but, as its territories increased, four principal mountains, situated in the extremities of the empire, and corresponding with the four quarters of the globe, were consecrated by the Emperor Hoang-tee, as the scenes of religious worship to the nation; and, in the course of every year, the sovereign went to these sacred places successively to offer worship, to shew himself to his people, to inform himself of their requests, to reform abuses, and to establish good order. It was afterwards more particularly ordained by the emperor Shun, that a solemn sacrifice should be offered at the second moon, or vernal equinox, on the eastern mountain, to implore a blessing on the seed cast into the earth; at the fifth moon, or summer solstice, on the southern mountain, to pray for a genial warmth upon the vegetating soil; at the eighth moon, or autumnal equinox, on the western mountain, for the preservation of the ripening crops; and at the 12th moon, or winter solstice, on the northern mountain, to give thanks for the blessings received during the preceding year, and to supplicate a continuance of the same favour through the approaching season. A fifth mountain was afterwards added in the middle of the empire; and the whole were in succeeding times called the five Yo, or mountains of sacrifice. These regular journeys, however, on the part of the emperor, having been found to be attended with numerous difficulties and inconveniences, an edifice was erected in the neighbourhood of the palace, which represented the Tan, the Kiao, and the hall of ancestors, or space between the fences of the Kiao, as a stationary and universal Yo; and here the emperor offered the appointed sacrifices, when it would not have been practicable or prudent for him to remove from his capital. This edifice contained five separate apartments, with four bare walls in each, without paintings or ornament, and with nothing but windows to admit the light; and it received from succeeding dynasties various additions, with new appellations. Under the dynasty of Hia, 2205 before Christ, it was named She-shee, or the house of generations and ages; and was rebuilt by the Shang 1766 years before Christ, with the appellation of Tchoo-oo, or the renewed temple. A similar structure was raised by the Tcheoo, and named Ming-tang, or the temple of light, 1122 years before Christ; but future dynasties, desirous to surpass their predecessors, divided the word ming or light into its component characters, Ge the sun, and Yue the moon; and built two temples, one to each of these luminaries. Hence arose a multitude of superstitions; and the wind, the rain, the thunder, diseases, &c. were all, in like manner, personified, and addressed as divinities, while warriors, emperors, and illustrious men, became demi-gods. The people forgot the simple worship of the Shang-tee, and embraced every new invention of idolatry with the utmost avidity.

Sect of the Tao-tse.

The most ancient of the religious sects, which have, at different periods, engrafted their superstitions upon the primitive theological system of China, is that of the Tao-tse, or sons of immortals, which was founded by a philosopher named Lao-kiun, or Lao-tse, who was born in the province of Honan, about 600 years before Christ, and concerning whose birth a multitude of strange stories are circulated among his countrymen. His mother, it is believed, suddenly conceived in a retired place, by the united influence of heaven and earth; continued in a state of pregnancy for the space of 80 years; and at length, under the shadow of a plum-tree, brought forth a son, with hair and eye-brows perfectly white. From these circumstances he received the names of Ly-eul, or *plum-tree-ear*, and of Lao-tse, or gray-haired child. Independent of these absurdities, Lao-tse is said to have held the office of librarian to one of the emperors of the dynasty of Tcheoo, by whom he was afterwards raised to the rank of an inferior mandarin. From his situation in the midst of books, he became addicted to literary pursuits, and acquired a profound knowledge of the ancient history and usages of his country; but, disgusted by the degeneracy of the times in which he lived, he travelled into the kingdom of Thibet, where he imbibed the tenets of the priests of Lama, and wrote a book entitled Tao-te-king, or the book of the power of Tao, composed of 5748 characters, and consisting of detached thoughts and maxims, expressed in a very concise and unintelligible style. According to his doctrine, the Tao is the principle of heaven and earth, the source of all that exists, a highly intelligent, but, at the same time, utterly incomprehensible being. He who desires to be united to the Tao is named Shing, and is the only wise man; and to attain this character, he is required to be free from the influence of every passion, to reject riches and dignities, to employ himself in no kind of sublunary pursuit, to keep silence, to censure nothing that exists, to live as if he lived not, and to cherish compassion to his fellow creatures.

His followers, named Tao-tse, therefore, place the supreme duty and felicity of man in a state of perfect tranquillity, recommending the suppression of all violent desires and passions, the utmost moderation in every pursuit or enjoyment, and an utter indifference with regard to the past, the present, or the future. But as this apathy, or tranquillity, which their master inculcated, and which they laboured to attain, was necessarily disturbed by the prospect of death, they adopted a notion, which they are supposed to have derived from the idea of the soul of the Lama passing into the person of his successor, and imagined, that a liquor might be compounded from the three kingdoms of nature, which would possess the virtue of renovating the vigour of the human body, and of rendering it finally immortal. In pursuit of this beverage of immortality, they addicted themselves to the study of alchymy, which they mixed up with various magical practices, tricks of divination, and other superstitious absurdities. The hope of avoiding death drew to them a multitude of followers, especially among the more opulent classes; and several of the emperors abandoned themselves entirely to their opinions and practices.

Their tenets made the most rapid progress throughout the empire; and the court was filled with the teachers of the system, who received the title of Tien-tse, or "celestial doctors," while their chief was honoured with the dignity of a grand mandarin, which his successors are said still to retain, residing in a splendid palace in the province of Kiang-see, to which multitudes of worshippers continually resort. These draughts of immortality, sought after with so much avidity, were not unfrequently rendered instrumental in cutting off the sovereigns and grandees of the empire, by administering a poisonous dose in their place; and, even in their most genuine state, they are supposed to have, in many instances, brought on a premature decease. This beverage of life, which is still held in great request, especially among the higher classes of the Chinese, is understood to be a compound of opium, and other stimulating drugs, which excite the system and exhilarate the spirits for a moment; but, by the frequent repetition of the dose, which the languor by which it is succeeded renders necessary, the constitution is at length exhausted, and the period of life is thus abbreviated, rather than prolonged, by the pernicious superstition.

This sect became particularly powerful under the dynasty of Song; and one of the emperors of that race carried his superstitious reverence for a celebrated teacher among them to such a length, as to command him to be worshipped under the name of Shang-tee, which had hitherto been appropriated to the Supreme Being. The sages of the nation were so greatly shocked by this act of impiety, that they predicted the ruin of that dynasty as fast approaching; and the wiser part of the learned men frequently presented strong remonstrances to different emperors against the patronage which was bestowed upon these deceivers; but the sect of the Tao-tse continued to increase in power and numbers, under the protection of princes, the countenance of the great, and the credulity of the people; and has preserved its extensive influence even to this day, in spite even of all the attempts of the celebrated Confucius to introduce more enlightened doctrines.

Sect of Confucius.

Confucius or Kong-foo-tse was born about 550 years before Christ, and is regarded by the Chinese as the chief of their wise men, and as the author of their whole civil constitution. He endeavoured to restore the ancient system, and to improve the conduct of his countrymen, by exhorting them to obey the commands of heaven, to love their neighbours, and to restrain their passions. Some of his philosophical principles are, that out of nothing there cannot any thing be produced; that material bodies must have existed from all eternity; that the cause or principle of things must have had a co-existence with the things themselves; that this cause, therefore, must also be eternal, infinite, and indestructible; and that the central point of influence, from which this cause chiefly acts, is the blue firmament, (tien) whence its emanations are spread over the universe; but neither he nor his disciples ascribe to the deity any personal existence, or represent the first cause under any distinct image; while the sun, moon, stars, and elements, are considered also as composing the firmament, or tien, as the immediate agents of the deity, and as the productive powers in creation. The universe, in short, according to this philosopher, is one animated system, made up of one material substance, and of one spiritual being, of which every living thing is an emanation, and to which, when separated by death from its particular material part, every living thing again returns; hence the term death is never used by his followers, but they say of a person, at his decease, that he has returned to his family. Thus he taught, that the human body is composed of two principles, the one light, invisible, and ascending, the other gross, palpable, and descending; that the separation of these two principles causes the death of human beings; and that, at this period, the light and spiritual part ascends into the air, while the gross and corporeal matter sinks into the earth. He taught, farther, that the spirits of those, who had performed their duty in life, were permitted to revisit their ancient habitations, and such places as might be appointed for receiving the homage of their descendants; that they have the power of conferring benefits upon their posterity; that it was thus the indispensable duty of every man to perform the sacred rites to the memory of his ancestors; and that, whosoever neglected this duty, would be punished, after death, by his spirit being rendered incapable of visiting the hall of ancestors, and receiving the homage of his descendants. Besides the performance of these sacred rites to the memory of ancestors, the principal religious worship which he required, was, that the prince, in the name of his people, should present offerings to the tien, particularly at the two equinoxes, for the purpose of obtaining a propitious seed-time and a plentiful harvest; but, at the same time, that the deity is always best satisfied when men perform the moral duties of life, which he comprised chiefly in these two, viz. filial piety towards parents, and unreserved obedience to the will of the emperor. With these tenets was naturally connected a belief of good and evil genii, and of tutelary spirits presiding over families, towns, mountains, and other places; and while the system of Confucius was little better than atheism in the mind of the philosopher, it became a source of gross idolatry among the people, who could not comprehend the more refined notions, but, needing some visible object upon which to fix their attention, represented the tutelary spirits by images, and worshipped them by sacrifices. Confucius himself was much addicted to a species of divination or fortune-telling, and says expressly in one of his works, that the wise man ought to know future events before they happen, and that this may be done by means of lots. His tenets, in short, instead of overcoming the old errors, gave rise to new superstitions; and the chief difference between the proper followers of Confucius and those of Lao-tse, is this, that the former inculcate the duty of living among men, and endeavouring to improve them; while the latter avoid every kind of society and occupation, and lead a frugal retired life, as their only felicity.

Sect of F

During the reign of the Emperor Ming-tee, of the Han dynasty, a new superstition was introduced into China, whose influence is perhaps still more extensive and pernicious in that country, than any of those by which it was preceded. One of the Tao-tse doctors had promised to a brother of the emperor's, that he would open to him a communication with the spirits; and this superstitious prince having heard of a spirit in Tien-tso, or Hindostan, named Fo, or Foe, prevailed upon the emperor, by his importunities, to send an embassy for this foreign divinity. When the officer, who was entrusted with this mission, arrived at the place of his destination, he found only two Sha-men, or priests of Fo, whom he carried to China, with some of their canonical books, and several images of the idol painted on linen. The followers of Fo describe him as the son of a prince of one of the kingdoms of India, near the line; and affirm, that as soon as he was born he stood upright, walked seven steps without assistance, and, pointing to the heavens with one hand, and to the earth with the other, cried aloud, "in the heavens and the earth there is no one but myself who deserves to be honoured." At the age of seventeen, he married three wives, by one of whom he had a son, named by the Chinese Mo-heoo-lo; but at the age of nineteen he abandoned his house and family, with all the cares of life, and committed himself to the care of four philosophers, with whom he retired to a vast desert. Being filled with the divinity at the age of thirty, he was metamorphosed into the Fo, or Pagod, as the Indians term it, and immediately thought of establishing his doctrines by miracles, which attracted numerous disciples, and spread his fame over every part of India. When he had attained his seventy-ninth year, and perceived from his infirmities that his borrowed divinity could not exempt him from mortality, he is said to have called his disciples together, and to have declared to them, that hitherto he had spoken to them by figurative expressions, but that now he would discover his real sentiments, and unveil the whole mystery of his wisdom, namely, that there is no other principle of things but a vacuum, or nothing; that from this nothing all things at first sprung; that to nothing they shall again return; and that thus end all our hopes and fears at once. After his decease, a multitude of fables were propagated concerning him by his followers, such as, that he was still alive, and had been born 8000 times, appearing successively under the figure of an ape, a lion, a dragon, an elephant, &c. His last words excited much dissension among his disciples, some of them resolving to adhere to his original tenets, others adopting his concluding atheistical view of things, and a third class attempting to reconcile both systems together, by making a distinction between the external and internal doctrine. The internal doctrine, to which the disciples of the idol are exhorted to aspire, is a system of the most absurd atheism; of which some of the principal tenets are, that nothing is the beginning and the end of all things; that all beings are the same, differing only in figure and qualities; that the supreme happiness of man consists in acquiring a resemblance to this principle of nothing, in accustoming himself to do nothing, to will nothing, to feel nothing, to desire nothing; that the sum of virtue and happiness is to be found in indolence and immobility, in the cessation of bodily motion, the suspension of all mental faculties, the obliteration of all feelings and desires; that when men have attained this divine insensibility, they have nothing to do with virtue or vice, rewards or punishments, providence or immortality, no changes, transmigrations, or futurities to fear, but have ceased to exist, and become perfectly like the god Fo. The external doctrine has the greatest number of followers. It teaches a great distinction between good and evil, and a state of rewards for the good, and of punishment for the wicked after death, in places suited to the spirits of each. It acknowledges the transmigration of the soul through different bodies, till it is at length completely purified and prepared to be united to the Deity. It affirms, that the god Fo came upon this earth to expiate men's sins, and to secure them a happy regeneration in the life to come. Its practical injunctions are simply these: To pray to the god Fo, and to provide his priests with temples and other necessaries, that by their penances and supplications they may procure for his worshippers, the forgiveness of their sins; and to observe five precepts, viz. to kill no living creature—to take nothing that belongs to another—to commit no act of impurity—to utter no falsehood—and to drink no wine. The practice of these duties is enforced by threatenings of future punishment, especially of transmigration into the bodies of dogs, horses, rats, serpents, &c. In consequence of this doctrine, a multitude of idols have sprung up wherever the religion of Fo has prevailed; and temples have been erected to quadrupeds, birds, and reptiles of every description, according as the god was imagined to have occupied any of their bodies in the course of his transmigration.

Fo is supposed to have lived 500 years before the time of Pythagoras; and from his followers the Grecian sage is conjectured to have learned the doctrine of the metempsychosis, when he travelled in India. The worship of Fo was introduced into China A. D. 69; and is understood to have been originally the same as that of the Indian Buddha, from the evident coincidences between the history and worship of the two divinities. The Buddha of the Hindoos was the son of Ma-ya, and one of his names is Amita. The Fo of China was the son of Moy-a, and one of his names is Om-e-to, or, as it is pronounced in Japan, Amida. The Menshin, or guardian spirit of the door in China, is the same as the Ganesa of Hindostan; and, in both countries, his figure, or at least the character expressing his name, is painted on the door of almost every house. The Lui-shin, or spirit of thunder of the Chinese, represented under the figure of a man with the beak and talons of an eagle, is equivalent to the Vishnu of the Hindoos, who is generally figured as riding upon an eagle, or at least attended by that bird; and it is noticed as a curious circumstance, that the same reason is assigned by the Chinese for giving an eagle's face to this idol, which Pliny adduces for the consecration of that bird to Jupiter, viz. that there is no instance known of an eagle having been killed by lightning. So, Hai-vang, king of the sea, represented in China as reposing on the waves with a fish in his hand, corresponds with the Hindoo Varuna riding on a fish; and the Indian Ganga or goddess of the Ganges, has an exact counterpart in the Shing-moo or holy mother of the Chinese, which will be described in its place.

Religious persecutions.

Between the followers of Lao-tse and of Fo, which have always been the two prevailing sects in China, the greatest rivalship and enmity have constantly subsisted, which frequently extended to persecution and bloodshed. Whenever the court or principal eunuchs appeared to favour the one in preference to the other; the more powerful sect at the time commenced hostilities against its opponent. These contests, however, were confined to the priests of the two religions; and the people either remained neutral or took no active part in the quarrel, which was seldom terminated but by the levelling of monasteries to the ground, and the slaughter of some thousands of priests on both sides. Since the accession of the Tartar dynasty, no particular preference or distinction has been shewn to either of them; and indeed, except that the priests of Lama are paid and supported by the Tartar government, as a part of the imperial establishment, and that the principal Tartar officers are attached to their tenets, (separated from the absurdities grafted upon them by the Tao-tse,) the government gives no particular support to any religious sect whatever.

Sect of Shao-kang-tse.

About the year of Christ 1070, under the dynasty of the Song, several learned men applied themselves to interpret the sacred books called King; and one of them named Shao-kang-tse, distinguished by his superior erudition, became the founder of a new system. He taught first of all, that the world had a beginning and will come to an end, when it will be again produced, and again destroyed in endless succession. He fixed its duration at 129,600 years, which he divided into twelve periods, each containing 10,800 years. In the first of these, the heavens were gradually created by the motion, which the Tay-kee impressed upon matter, which had hitherto remained immoveable; in the second, the earth was produced in the same deliberate manner; in the third, men and the other living creatures began to come into existence; and so on to the eleventh period, when all things shall be destroyed, and the world shall return into the state of chaos, from which it shall not again be evolved till the end of the twelfth period. About the year 1400, the Emperor Yong lo of the Ming dynasty, commanded several learned men to combine the principles of Shao-kang tse into a system, by interpreting the books of Confucius and Meng-tse, called King. In this work they gave the name of Tay-kee (or great height) to the cause of all things, although this word is not to be found in the writings of Confucius or Meng-tse; but, from a passage in one of the commentaries of the former philosopher, they profess to derive those tenets, that Tay-kee is separated from the imperfections of nature, is an existing being, and the same with the heaven, the earth, and the five elements; that when he moves, he produces Yang, that is, subtle and active matter, such as the heavens, fire, day, that which is perfect and of the male sex; that, when he rests, he produces Yn, that is gross and motionless matter, such as the earth, the moon, darkness, that which is imperfect and of the female sex; that, by the union of these, are produced eight elements, which, by their various combinations, form the peculiar and distinguishing nature of all bodies, the vicissitudes of the universe, the fertility or barrenness of the earth, &c. From these and similar mysticisms, the partisans of Tay-kee went on in their speculations, till they ended in atheism, by excluding from the world every supernatural cause, and admitting only an inanimate virtue or energy in union with matter. In their system of morals, they adopted more rational principles; directed the wise man to make the public good the great object of his actions, and to extinguish his passions, that he may follow the light of reason; and explained the reciprocal duties of princes and subjects, of parents and children, of husband and wife.

Mixture of tenets.

None of these different systems can be said to be the prevailing creed in China; or, what is more remarkable, can be found existing pure and distinct from the rest. The greater part of the Chinese have no decided opinion whatever on the subject, and are either complete atheists, or, if they acknowledge a Supreme Being, utterly ignorant in what view he ought to be regarded; while they all combine with their peculiar sentiments the multifarious superstitions of the more popular sects. Of all these tolerated and established religious persuasions, the emperor is the supreme head; without whose permission not one of them can enjoy a single privilege or point of pre-eminence; and who can diminish or increase, at his pleasure, the number of their respective temples and priests.

The existing worship of China, then, is a confused mixture of superstitions, of which individuals receive and observe just as much as they please; and those parts of it, which the government seems to uphold, may be viewed rather as political than religious institutions. The emperors reserve to themselves the privilege of adoring the Tien, but they equally sacrifice to the spirit of the earth, the sun, or the moon, and attach themselves more or less to the notions of the Tao-tse or of Fo. While the reigning Tartar family acknowledge more particularly the faith of the Grand Lama, they nevertheless perform the established sacred rites of their predecessors, and repair to the festivals which the calendar prescribes. And, while the literati study the doctrine of the King, they are as superstitious as unbelieving, and are found with others in the temples praying to the idols.

National worship.

There is only one temple consecrated to the Tien in the whole empire, called Tien-tan, or the eminence of heaven, and is situated in the Chinese division of the city of Pekin, where the emperor offers a sacrifice at the winter solstice, consisting of oxen, hogs, goats, and sheep. The Tee-tan, or eminence of the earth, is also situated in the Chinese city, and is covered with green tiles; where the emperor, in like manner, sacrifices to the earth at the summer solstice. The Ge-tan, or temple of the sun, is on the outside of the Tartar city towards the east; and thither the emperor sends a prince every year, at the vernal equinox, to perform the rites in honour of that luminary. The Yue-tan, or temple of the moon, is also situated on the outside of the Tartar city, towards the west; and thither the emperor sends a person, in like manner, at the autumnal equinox, to perform the ceremonies in honour of the moon. These different structures have been adorned in modern times with all the magnificence of architecture; and when the emperor is about to offer sacrifice in the temple of the heaven or that of the earth, the greatest pomp and solemnity is observed. Previous to the intended ceremony, the monarch and all the grandees, who are entitled to assist, prepare themselves, during three days, by retirement, fasting, and continence. No public audiences are given, and no tribunals are open. Marriages, funerals, and entertainments of every kind are prohibited; and no person is permitted to eat either flesh or fish. On the appointed day, the sovereign appears in the utmost possible splendour, surrounded with princes and officers of state, and attended by every circumstance demonstrative of a triumph. Every thing in the temple, corresponds in magnificence with the appearance of the emperor. The utensils are all of gold, and never applied to any other purpose; while even the musical instruments are of an uncommon size, and also reserved for such solemn occasions. But while the monarch never displays greater external grandeur and state, than during these processions, he never exhibits greater personal humility and dejection than during the time of sacrifice, prostrating himself on the earth, rolling in the dust, speaking of himself to the Shang-tee in terms of the utmost abasement, and apparently assuming so much magnificence of appearance and attendance, only to testify, in a more striking manner, the infinite distance between the highest human dignity and the majesty of the supreme Being.

Ceremony of commencing the seed time.

One of the principal religious ceremonies, which the emperor performs, is that which regards the tilling of the ground, and which takes place at the vernal equinox. He prepares himself for this festival by three days solemn fasting and worshipping: and then, going forth in great pomp, takes the plough into his hand, opens the earth, and sows the first seed of the season; while the same is done in every part of the empire by his governors and viceroys as his substitutes. The grain which is gathered from the seed, thus sown by the royal husbandman, is reverently deposited in a sacred granary, and reserved for great sacrifices to the Shang tee. This ceremony may be regarded as a wise political institution for the encouragement of agriculture, as well as an act of religious worship. On the day of this observance, a cow is sacrificed in the temple of the earth, and figures of cows are carried in procession, which are afterwards broken in pieces and distributed among the people; a circumstance, which gives this ceremony some resemblance to the worship of Osiris in Egypt, from which it has not improbably been supposed to derive its origin.

Festivals.

New year.

As there is no regular day of religious rest in China, and experience proves, that certain seasons of cessation from labour are necessary for human beings, there are a number of public festivals in the course of every year, which may be considered both in the light of recreations, and of religious observances. One of the most remarkable of these takes place at the new-year; and is universally celebrated throughout the empire, at great expence. Every one endeavours to collect some money for the occasion, dresses in his best apparel, dispenses with every kind of business, and particularly provides himself with new shoes. The new-year is welcomed by firing immense quantities of crackers, with the fragments of which it is said the streets are sometimes so completely covered, that the pavement cannot be seen. The day is employed in paying visits, giving presents, and congratulating almost every one that comes in the way. Red papers are suspended around the doors, as a mean of securing good fortune through the year; and some quarters are illuminated with lanterns.

Feast of lanterns.

On the 15th day of the first moon of the year, occurs the feast of lanterns, which frequently continues for several days; and which is celebrated by suspending numbers of lanterns before the doors of the houses, and in the middle of the streets; while the more wealthy give entertainments to their friends, and exhibit shows, fireworks, &c. to the populace. Different and very trifling reasons are assigned by the Chinese for the origin of this ceremony; one of which is, that the daughter of an eminent mandarin having fallen into a river, in which she was drowned, her father and the people of the place sought her a long time in vain, with the help of lanterns; while another story bears, that one of their emperors, displeased that his pleasures should be interrupted by the continual alternation of day and night, resolved, with the advice of one of his wives, to build a palace which should be impenetrable to the rays of the sun, which he lighted up with a multitude of lanterns, and in which he kept himself continually shut up amidst his dissipations; but that the people rose in a tumult, destroyed his palace, and drove him from his throne; and that the feast of lanterns is annually observed, at the date of this event, as a warning to voluptuous monarchs.

Feast of boats.

On the fifth day of the fifth moon is the feast of boats, which is said to have originated in a search made with boats for the dead body of a drowned mandarin. On this occasion, they make use of long narrow boats, painted with various figures, and containing often more than 60 rowers in each. These move along to the sound of drums and copper kettles, sometimes slowly, and at other times with great rapidity, striving to outstrip each other in their course; but, in this contest, boats are so frequently overset or dashed to pieces, and sometimes so many lives lost, that the mandarins often prohibit the celebration of the festival.

Solemn processions in time of drought;

In harvest

In honour of the dead

At Eclipses.

In the months of July and August, solemn processions are made, and in seasons of great drought, sometimes public fasts are observed, to supplicate the gods for rain, and to procure an abundant harvest. The country is at these seasons often covered with processions of this kind, accompanied with music, and carrying flags and small shrines, while the mandarins repair to the temples to intercede with the idols; and it is generally forbidden to kill a hog, or to eat flesh till the object of these petitions be granted. There are great processions in autumn, in which are carried lanterns, and large paper fishes; and four men support a table loaded with fruits, on which stands a young girl, with a younger one at her side, and another before dressed in the habit of an old man. The march begins with music and firing of crackers, while the inhabitants of the places through which the procession passes, cover tables at their doors with fruits, betel, and tobacco, which they present to the persons who compose the company. Similar processions also are made, chiefly during the spring months, in honour of the dead; and the order of march in these cases is generally as follows: A person first appears carrying gilded papers, followed by musicians, and children holding in their hands figures of men, horses, and birds, made of paper; next a company with lanterns, blue and white flags, parasols, and paper shrines; after these, a small wooden pagoda, attended by seven or eight bonzes uttering prayers; and last of all, a party well dressed, or clothed in mourning. Lanterns are lighted at the periods of new and full moon; and during eclipses of the sun or moon, when the Chinese imagine that these luminaries are in danger of being devoured by a dragon, then there is a general assemblage in every town or village, of mandarins, literati, citizens, and peasants, offering prayers for the safety of the labouring planet, beating upon drums and kettles to frighten the devouring dragon, and continuing the din without intermission till the termination of the eclipse. These and similar festivals may be regarded as the remains of the more ancient system; but the superstitions of the several later sects are incapable of arrangement or enumeration.

Temples.

There are numbers of temples and pagodas in every part of China, many of which are very extraordinary structures. These are in general named Miao, and may be distributed into two classes; first, those which are of considerable size, and which are well endowed with houses and lands; and secondly, those which have been built by private individuals, or a few priests; and one of this description may be seen in the vicinity of almost every palace belonging to the emperor. In every spot, also, where there is any kind of danger to be apprehended, small pagodas are erected, where travellers go to implore the protection of the spirit to whom they are dedicated; or, if they are prevented from entering the place, they burn their bits of paper, and beat upon their copper kettles as they pass. The temples have a great resemblance to the convents of Europe, are generally built in a simple style, and have their courts adorned with trees. They are constantly open; and at the entrance there is seen, in a hall or pavilion, a large drum and bell, upon which the worshipper strikes with a wooden mallet. In the apartment of the principal divinity, is placed a table covered with nosegays and vessels of perfumes; and a spiral candle composed of sandal wood and odoriferous gums is suspended before him, which is kept continually burning. In every city, almost, there is a temple dedicated to Confucius, as a tutelary spirit, in which either his statue or picture is preserved; and, in the seasons of spring and autumn, sacrifices are offered there in honour of this philosopher and his disciples, particularly by those who are about to undergo any literary examination. Besides these temples, numerous small chapels are to be seen in the country and villages, dedicated to the different spirits presiding over the land, the water, the mountains, &c.; but frequently, instead of a temple, there is merely a stone placed upright at the foot of a tree or bamboo bush, with the name of the tutelary divinity engraved upon it, and a few paper flowers by way of ornament.

Pagodas

One of the pagodas at Canton is thus described by M.

De Guignes; "After passing the two gates at the entrance, you find a court, which leads to two porches, one of which contains four figures cut in stone, in a sitting posture, and the other has four pavilions of two stories, full of idols. Around this court is a gallery supported by pillars, which serves as a place of communication to the cells of the ordinary priests, which are very small, and receive the light only by the door; and the principal priests have their habitations, consisting of two floors, at the angles of the square. In the middle of the galleries, are the dining-room and kitchens on one side, and the infirmary on the other. In the second inclosure is a herd of stags, and on one side several large fat hogs; and these animals having been devoted to the deity during the sickness of some bonze, are allowed to go at liberty till they die of old age." Another, dedicated to the goddess Poosa, was particularly noticed by Mr Barrow, in the province of Canton, which bore a great resemblance to the immense excavations and sculptures in the granite mountains of Hindostan. In the front of a rock, about 700 feet above the bed of a river, was a large cavern, with a terrace before it, accessible by a flight of steps; and from this cavity another flight of steps led to a spacious apartment, in the centre of which sat the figure of the idol upon a kind of altar, hewn into the shape of the Lien-hoa, or nelumbium plant. The sides of this place were covered with inscriptions carved or painted; and the whole rendered visible by a dim light through a small opening. The priests lodged in small caves, branching out from this large apartment. A third flight of steps conducted to a second story, with a small opening in the front, which was nearly filled with a large stalactite; and in this room was a gigantic image of a horrible aspect, with a crown on his head, a naked scymitar in one hand, and a fire-brand in the other, supposed to represent some deified hero.

The dragon is held in great veneration in China, and is called the spirit of the air and of the mountains. He is represented as covered with a buckler of tortoise-shells, sustaining the globe, and watching for its preservation. His figure is one of the imperial insignia; and the emperor alone has the privilege of wearing a dragon with five claws embroidered upon his robes.

Idols.

The temples in general contain an immense number of different figures, some of which are of a colossal stature; and these are generally placed at the entrance. They represent various genii, or guardian spirits, whose respective attributes are expressed by certain emblems connected with their statues. Thus, a sabre announces the god of war: a guitar, the god of music; a globe, the spirit of heaven. Some of these are frequently 30, 50, 60, and even 80 feet in height, with a multitude of hands and arms. One of the most stupendous in China is a goddess of the class of Poosa, which signifies all-helping, or plant-preserving, and is apparently a personification of nature. She is represented sometimes with four heads, and 40 or 50 arms, each of the heads being directed towards one of the cardinal points, and each of the arms holding some useful production of the earth; each arm also often supports a number of smaller arms, while the head is covered with a group of smaller heads. One of these idols, seen by M. Van Braam was 90 feet high, with four heads and 44 arms. The divinities in the interior of the temples are of smaller proportions, and in various postures; sometimes alone, and at other times surrounded by a number of inferior idols; some with the heads of animals, others with horns on the forehead; some reclining as at rest, others seated cross-legged upon flowers or cars; but all of them represented in a state of great corpulency, which the Chinese regard as an honourable quality. The idol Fo is seated upon a nelumbium flower, a species of water-lily. The goddess of lightning stands erect, with two circles of fire in her hand, and a poignard at her girdle. The spirit of fire walks upon burning wheels, and holds a lance and circle. The goddess of all things, named Teoo-moo, with eight arms, is seated in a chariot drawn by seven black hogs. The goddes Shing-moo, or Holy mother, the most ancient and common of all the female deities, whose character implies universal understanding, or more literally, "the faculty of knowing all that ear has heard, or mouth has uttered," was considered by the Catholic missionaries, as a shocking resemblance of their Holy Virgin. Her statue is generally represented with a glory round the head, and a child in her hand or on her knee, holding a flower of the Lien-hoa, (nelumbium,) or placed upon a leaf of that plant. Her legend is, that, when she was bathing in a river, she happened to eat a flower of the nelumbium, and immediately became pregnant; that when the period of her gestation was completed, she repaired to the same spot where she had first picked up the flower, where she brought forth a son, who afterwards became a celebrated personage, performed miracles, and gave laws to the whole empire. There are divinities, in short, of all possible shapes, and so numerous that one pagoda on the lake See-hoo contained 500 of them within its walls.

Deified men.

Among the multitude of figures of metal, stone, wood, or baked clay, painted, varnished, and gilt, with which the temples are crowded, are frequently to be seen the statues of emperors, mandarins, and other great personages, who have been friendly to the sect in general, or to that particular convent, or who have left a sum of money to procure a niche for their images among the divinities.

Household gods.

Besides these places of public resort, the Chinese have always an altar in their private dwellings, and a few small idols, before which they burn gilded papers, especially at the new and full moon; and there is generally placed upon their door the name or figure of the idol Men-shin, who is a kind of household god, and who is represented with a club in one hand, and a key in the other.

Bonzes.

The priests, officiating in these different temples, are either the followers of Tao-tse, or of Fo, the latter of whom are called Ho-tchang; but both are generally denominated by the name of Bonzes; and indeed they resemble each other so nearly in their appearance and functions, that they are scarcely distinguishable. The Bonzes of Tao-tse are generally devoted to celibacy, and associated in convents like the Romish monks. They wear a long robe, with large sleeves, and without a neck. They never shave their heads, but collect their hair upon the crown. In performing their worship, they move in procession round the altar, on which the sacred flame is kept burning, chaunting in recitative, and bowing their bodies as they come in front of the altar, while gongs and musical plates are sounded at certain intervals. In their dresses, altars, images, incense, bells, candles, chaunting, &c. they bear a striking resemblance to the Catholic exhibitions; and one of the missionaries, much hurt at the similarity, makes the following observations on the subject; "there is no country where the devil has so successfully counterfeited the true worship of the Holy Church. These priests of the infernal spirit wear long loose gowns, exactly resembling those of some of the fathers; they live in temples, like so many monasteries; and chaunt in the same manner with us." They sacrifice to their idols a hog, a fowl, and a fish; and then observe a multitude of ceremonies, incantations, mystical rites, and magical practices, which frequently vary according to the fancy or skill of the actor. They act also the part of fortune-tellers, in which they are sufficiently expert, representing the figure of their chief in the air, causing the pencil to write the oracular response of itself, shewing the figures of persons in a bason of water, &c. They attend at funerals, to drive away evil spirits; profess to cure the sick by their incantations or intercessions; and pronounce a benediction upon the ships, when first launched into the sea. They run about the streets lashing themselves, as an expiation for the sins of their votaries, and collecting money as the price of their services.

The priests of Fo live also in a state of celibacy, and in large convents, which the Chinese call Poo-ta-la, which is the mode in which they pronounce the word Buddhalaya, that is, the habitation of Buddha. They shave their heads, and wear long gowns, generally of a yellow or black colour, to which on days of ceremony they add a red bonnet and scarf. They have a kind of chaplet round their necks, consisting of a number of beads; and in some of their acts of worship they march, like the Tao-tse, round the altar, counting these beads as they move, at every bead bowing the head respectfully, and repeating the word O-mi to-fo; and when the whole string is finished, they make a mark with chalk, in order to register the number of their ejaculations to the god Fo. They eat no flesh, fish, or onions, drink no wine, and lead, in short, a very abstemious life; but are nevertheless, it has been observed, sufficiently fat and well grown.

The bonzes are generally regarded with contempt, as persons who deprive their country of that personal labour, which is counted in China as a sacred duty; and it is only persons advanced in life, or of the lowest class of people, who join their society. Hence it is their practice to purchase young children to learn and to perpetuate their system; and, to attract the greater respect and confidence, they employ every possible mode of acquiring riches, and securing reverence. When consulted with respect to the most fortunate spot for building a house or erecting a sepulchre, they have generally a secret understanding with the proprietor of the ground, which they pronounce to be the most desirable, and share with him the price of the purchase. To secure the protection of the emperor or chief mandarins, they place them among the number of their divinities; and to draw the populace to their temples, they announce prodigies of various kinds, and threaten dreadful transmigrations to those who neglect to bring offerings, and to secure the benefit of their prayers. In these offerings, animal victims are now rarely seen, on account of the great scarcity of sheep and the value of hogs; but fruits and roasted fowls are the principal gifts. Even these, however, are seldom left for the idol or the priests, but are carried away by the worshipper, after the invocation has been performed; and, in their stead, a sum of money is given to the bonzes of the temple. In these acts of devotion, it has been remarked that the Chinese appear to be actuated rather by a dread of some evil in this life, than the fear of punishment in another; that they perform their sacred rites more with a view to appease an angry deity, and to avert impending calamities, than from any hope of obtaining a positive good; that they rather consult or inquire of their gods what may happen, than petition them to accomplish or avert it; that a Chinese can scarcely be said to pray, but while he may be grateful when the event proves favourable, is petulant and peevish when it is adverse. They hold the different idols in more or less estimation, according to the favours, which they are supposed to have conferred upon their votaries; and when, after repeated applications, their suit is not granted, they abandon the spirit of that temple as a god without power, or perhaps pull down the edifice, and leave the statues exposed in the open air. Numbers of temples are thus seen in ruins, their bells lying on the ground, their monstrous idols standing unsheltered, and their bonzes wandering in quest of alms or a more fortunate asylum. Sometimes the fallen deity is treated with the utmost outrage and contempt. "Thou dog of a spirit," the enraged votaries will say, "we lodge thee in a commodious temple; thou art well gilt, well fed, and receivest abundance of incense; and yet, after all the care bestowed upon thee, thou art ungrateful enough to refuse us necessary things!" Then, tying the idol with cords, they drag it through the kennels, and bespatter it with filth. But should they happen, during this scene of vengeance, to obtain, or to fancy that they have obtained, their object, then they carry back the insulted divinity to its place with great ceremony, wash it with care, prostrate themselves before it, acknowledge their rashness, supplicate forgiveness, and promise to gild it again, upon condition that what is past be forgotten. Sometimes those, who have found all their gifts and worship unavailing, have brought the idol and its bonzes to a solemn trial before the mandarins, and procured the divinity to be dismissed as useless, and its priests to be punished as impostors.

Sacred offerings.

Pilgrimages.

Among the Chinese superstitions, pilgrimages are not wanting; and on certain mountains in every province are holy places, more or less revered, to which the more devout worshippers repair from immense distances, and which they are required to ascend by dragging themselves along on their bended knees. Such as are unable, by age, infirmities, or urgent avocations, to make their sacred journeys, commission their friends to bring them a consecrated leaf filled with various characters, and stamped by the bonzes, in the centre of which is a figure of the idol Fo, surrounded with a number of circles. Every time that they count over their beads at seasons of devotion, they make a red mark upon one of these circles; and this leaf, which is the register of their prayers, is occasionally laid before the bonzes, that they may attest the number of circles thus marked, and imprint their seal upon the record to render it authentic. This important memorial, which it requires considerable sums to render duly formal, is carried with great solemnity at the funeral procession of its possessor, deposited in a small sealed box, and considered as his passport to the other world.

Superstitions.

Every trouble in China is attributed to the influence of some evil spirit, which every one's imagination frames to himself, and which he places, as it pleases him, in an idol, an old oak, a lofty mountain, or at the bottom of the sea. These mischievous spirits are considered by some as the souls or purified aërial substances of animals, such as of foxes, apes, frogs, &c.; and these creatures are supposed to have the power, after living a certain number of years, to divest themselves of the grosser parts of their nature; and, after becoming pure essences, to take delight in tormenting human beings, especially by exposing them to diseases. Hence, in time of sickness, the principal remedy is to send for the bonzes, to banish, by their noises and incantations, those malignant spirits.

In every possible circumstance of life, the Chinese implore the protection and aid of some deity. Should a countryman be about to raise some large stone, or to at-

Lucky and unlucky days.

Calculation of their destiny.

tempt any work in which he might be in danger of receiving some injury; he places a small stone upright, surrounds it with a few candles, burns two or three gilded papers, and then applies to his labour with perfect confidence. When they have any dread of losing their children, they consecrate them to some divinity; and, in this view, they pierce the ear of the child, and suspend from it a small plate of copper, silver, or gold, with the name of the tutelary spirit inscribed upon it; or they simply tie the hair of the head on each side, into the form of a small tuft, which indicates that they are devoted to some god, who will preserve them from accidents and misfortunes. They pay great regard to lucky and unlucky days; and the government even publishes an annual calendar, in which, among other matters, the favourable moments in that season are properly marked. Midnight is always a lucky point of time, because in their opinion the world was created at that hour. But, of all their superstitions, the two following are the most prevalent, and form the chief object in their various acts of worship in the temples. 1. The calculation of their destiny, which they call Sooan-ming, and which is generally done by blind musicians, who go from house to house, playing on some musical instrument, and offering their services for a little money; whose art consists chiefly in astonishing their hearers by speaking learnedly of the position and influence of the stars, and in describing the proper idol to whom sacrifices must be offered, or the Bonze whose prayers must be secured. 2. The securing a good influence, and fortunate exposure, in building their habitations or sepulchres, which is called Fong shooy, "or wind and water." Upon this depends every one's success and happines in life; his natural abilities and genius, his advancement to honours, his commercial prosperity, good health, a numerous family, are all ascribed to his house or his burying-place having a happy situation, and his thus possessing a lucky Fong-shooy. They are constantly employed in devising means to render this circumstance or influence favourable. Much depends upon having the doors of their habitations placed under the protection of a proper spirit, arranged in a proper order, or constructed in a proper form. A round door is fortunate, and there is generally one at least in every Chinese dwelling. It is bad to have two doors directly opposite to each other, as the evil spirit, in that case, more easily enters. When this cannot be avoided, they put up screens of wood to stop the genius in his progress, or form their doors in the shape of a fan, a flower, a leaf, which all contribute to bewilder the malignant spirits, and to make them afraid to leap over. Should a neighbour build a house close to another, but not upon the same plan, or should there be any corner or slanting of the roof, so placed as to cross that of the other, this is enough to occasion desolation and distress to the proprietor, who lives in constant apprehension of some malignant influence. Should a law suit fail to relieve him from the adverse encroachment, his only resource is to raise on the middle of his roof an enormous figure of a dragon, in baked earth, darting a furious look upon the fatal angle, and opening its mouth so as to swallow the offending object: this removes all apprehension, and restores the tranquillity of the household.

Lots.

But, in both the last mentioned superstitions, great dependance is placed upon casting of lots, which is practised in two ways. One is to burn incense before an idol, which stands upon an altar, containing a number of small flat sticks, from eight to twelve inches in length, upon which are traced a variety of unintelligible figures, supposed to contain answers to the questions of every supplicant. After various prostrations and ceremonies, the person, consulting the oracle, draws out at random one of these small sticks, and receives an explanation from the Bonze, who accompanies him, or finds a tablet upon the wall of the temple containing solutions of the several enigmas. Another way is to take two pieces of wood, about six or seven inches long, cut in the form of a split bean; and to throw them up in the air, repeating the operation till they fall in a fortunate position. These consultations are accounted necessary before undertaking a journey, commencing a law suit, entering into the married state, building a house, or engaging in any important business. They are the chief occupation of the numerous Chinese who are seen in the temples; and, as they find these oracles in the pagodas both of Lao-tse and Fo, they repair to either of them indiscriminately.

The other religious sects, known in China, but who are chiefly foreigners, are Jews, Mahometans, and Christians.

Jews.

The Jews are supposed to have found their way into China, after Alexander, by his conquests in the East, had opened a communication with India; and their arrival in the country is said to be noticed in the historical records of China. The date of that event is fixed by some in the year 206, and by others in the year 258 before Christ. They abound chiefly in the silk provinces, especially in the neighbourhood of Hang-tchoo-foo, and are the best manufacturers of that article; whence it has been conjectured, that they first introduced the silk-worm into the empire. They are not very numerous, and are called by the Chinese, Hoey, or Lang-mao-hoey, that is, Hoey with the blue bonnets, because they wear a species of turban of that colour, when they assemble in their synagogues.

Mahometans.

Some Mahometans are supposed by the missionaries to have entered China about the year 599, which is however twelve years sooner than Mahomet appeared in the character of a prophet. Many learned Mahometans, from Balk and Samarcand, accompanied the Western Tartars when they invaded China, A. D. 1279; and were of great use to the vanquished Chinese, in improving their astronomy, correcting their calendar, and introducing the knowledge of various philosophical instruments. They became extremely numerous under the following dynasty of Ming, who expelled the Tartars, and began to reign A. D. 1368. The method, which they employed to increase their sect, was to purchase children, or to collect the foundlings, whom they educated in their tenets; and the various calamities of the times supplied them with many at that tender age, whom their parents were unable to support, or who had lost their relatives amidst the desolations of their country. There are not many of this sect in the body of the empire; but numerous tribes of them inhabit the extremities of the province Shen-see, distinguished by the Chinese into three different bodies, according to the mode in which they cover their heads. Of these, about 100,000 are supposed to have been cut off by the orders of Kien-long, during the insurrection which they excited in 1784.

Christians.

During the seventh century, about the year 635, a few Christians of the Nestorian sect passed from India to China; and were tolerated by the government nearly two centuries, under the designation of priests of Ta-tsin. But, in the year 845, they were proscribed by the emperor Voo-tsong at the instigation of some of his favourite Bonzes; and, after suffering a severe persecution, appear to have been completely extirpated. In the beginning of the 13th century, a number of Christians, of the Greek church, who had followed the army of Genghis-Khan, entered China along with the Tartars under Kublai khan; and received from that emperor a grant of a space of ground, within the walls of Pekin, for the purpose of erecting a church. Marco Polo, the celebrated Italian traveller, who visited China about this period, accompanied three missionaries of the Dominican order, who were sent from Venice to Pekin, at the express desire of Kublai-Khan; but, whether from a want of encouragement or of zeal, they returned in a short time to their native country with no small degree of wealth, acquired chiefly by trading in their progress through the East. About the middle of the 16th century, Francis Xavier, at the head of a company of Romish missionaries of the order of Jesuits, reached the island of San-shian on the coast of China, where he died in 1552; and, after a communication was opened with India by the Cape of Good Hope, a number of Romish priests passed into China to propagate the faith. In this view, they took care, in the first instance, to render themselves useful to the government as interpreters, astronomers, mathematicians, and mechanics; and, in general, found means to acquire wealth and respectability. The Portuguese particularly, who hold the highest stations in Pekin, are in possession of good estates and country seats; and the French Jesuits, before the dissolution of their society, were a very rich and powerful body in China. These missionaries, however, especially the Portuguese, are said to be extremely jealous and illiberal towards each other; and it was in a great measure owing to their frequent dissensions, that the Christians in China have been so severely persecuted. The most inveterate of these contests took place between the Jesuits and the Dominicans; the former of whom, by assimilating their opinions and practices in a great degree to those of the Chinese sects, and by professing, that they were come only to restore the ancient religion of the country to its original purity, when first delivered by their great philosopher Confucius, began to gain immense numbers of followers, who were half Christian and half Pagan in their sentiments and manners. The Dominicans, upon their arrival in the country, at once condemned these compromising arts, excluded these mixed proselytes from the number of Christian converts, and prohibited their followers among the natives from observing any of their ancient rites, especially from practising that fundamental national duty of sacrificing to their deceased relatives in the hall of Ancestors. The Franciscans adopted the sentiments of the Dominicans; and represented the conduct of the Jesuits to the Pope in such a point of view, that he sent out a bull to China, forbidding all the Catholic missionaries to permit the union of any idolatrous ceremonies with those of the church. But the Jesuits, whose superior talents and useful services had secured the protection and favour of the reigning sovereign Kang-hee, treated the injunctions of the Pontiff with contempt, and continued to make converts according to their own plan. They obtained a grant of land from the emperor for the purpose of building a church at Pekin; and received a dispensation from the succeeding Pope in favour of their proceedings in the conversion of the Chinese. Representations from the Dominicans and Franciscans were again transmitted to Rome, representing the Jesuits as the greatest enemies to the Christian faith; and these were followed by contra-remonstrances on the part of the Jesuits, with an attestation from the emperor himself, bearing, that the ceremony of paying homage to the dead, as practised by the Chinese Christians, was not of a religious but of a civil nature, and a duty which the political constitution of the empire rendered indispensable.

These disputes were at length carried so far, and the mandates of the Pope requiring the Chinese converts to desert those ceremonies which the government regarded as an essential law of the country, became so threatening and imperious, that the emperor at last conceived his authority to be attacked, and interdicted the Christian faith from being taught in his dominions. His son and successor, Yong-tching, began his reign with imprisoning, banishing, and putting to death the missionaries and their adherents in great numbers, and permitted only a few, whose assistance was needed in regulating the calendar, to remain in the metropolis. In spite of these persecutions, which have been renewed in every reign, and which particularly prevailed in the year 1785, numbers of new missionaries are occasionally making their way into the country; and two young men, under that character, requested and received permission to join Lord Macartney's embassy, and to proceed with him to Pekin. Missionaries. There are two kinds of missions in China; one which is approved by the government, and resides at Pekin, and which the Chinese now find essentially necessary in transacting many of their most important public affairs; and another in the empire at large, which the government does not avow, but which the mandarins are sometimes backward to detect, lest they should be punished for not having been sufficiently watchful to prevent the first entrance of the missionaries into the country, and are therefore not always very much disposed to question any one publicly respecting his faith. Both of these missions are often highly useful in a political view to the nation, with which they are connected; and we quote the following sentiments of M. De Guignes on the subject, as of no small importance in more respects than one. "The mission of the interior costs very little to support it. Men will not easily be found more virtuous and disinterested than those individuals, of whom it is composed. Deprived of all the comforts of life, subjected to every species of privation, and exposed every day to the risk of being put to death, nothing but the desire of acquiring information and propagating the Christian faith, could make them despise the evils which they endure. I speak here without prejudice; I relate what I have myself witnessed; and I feel myself constrained to speak the truth. The French government, by supporting missionaries, who pervade the vast empire of China, has always the power of procuring useful information, with respect to commerce, the situation of places, and a thousand other important objects. I am not the blind admirer of all missionaries; but I know many of them, whose attainments are very extensive, as their writings also sufficiently prove; and it cannot be denied, that we owe a great deal to those laborious and indefatigable men." "With regard to the mission at Pekin, its utility is sufficiently demonstrated by facts; and a person must be utterly blind not to acknowledge the importance of having one, duly authorised, at this capital. A similar establishment would be purchased with heaps of gold by a rival nation; and it would give any thing in the world to have the power of employing these means at its pleasure. As long as China shall remain shut against Europeans, the nation who shall preserve some individuals at Pekin, may account herself fortunate. By their means, she may be able to know, to prevent, to undertake every thing. I speak from known facts, but of which the details cannot be divulged. It is then, I repeat, of the last importance, Religion.

and a measure of the soundest policy, that the French government afford succour to the missionaries, and extend protection to those persons who are truly respectable." Missions, indeed, can never be considered as securely established in China, as the whole character and manners of the nation are against the progress of the Christian religion; and no dependence can be placed upon the natives, who will change opinions, every moment, according to circumstances. One great hindrance will always be found in the despotic nature of the government, which cannot endure that one of the people should have a single sentiment or observance, which it could not have power to alter or suppress. By letters received from Canton in 1802, it appeared, that the prohibitions against the Christians had greatly relaxed in their rigour; and that the emperor had actually issued an edict permitting the residence of the Roman Catholic missionaries in any part of his dominions, within twenty miles of the court; in consequence of which indulgence, it was added, that a number of converts had been baptized. It appears, however, from a subsequent edict, dated 1805, that the labours of some of those missionaries had excited the alarm of the government; and that a persecution was then carrying on against the Christians. The edict admits the right of Europeans, settled in the country, to practise their own religious usages; but declares it to be an established law of the empire, that they should not propagate their doctrines among the natives. A missionary residing at Pekin, and named Odeadato, who had made many converts, and also printed several religious tracts in the Chinese language, was banished for life to Gehol in Tartary; and a number of the Chinese, who had become Christians under his instructions, or been assisting to him in his plans, were condemned to suffer punishment, according to their respective degrees of guilt. It was further declared, that all, who shall hereafter frequent the houses of Europeans, in order to learn their doctrines, will be punished with the utmost rigour of the law.*

Laws.

The laws of China are directed by the government to be carefully taught to the people, by the mandarins of the respective districts; and it may be said, that jurisprudence is the only religion, which is inculcated by authority in this vast empire. The laws are also published for the use of the subjects, in the plainest characters of the language, and in a popular and easy style. A republication takes place, at the accession of every new dynasty, of the subsisting statutes, which forms the Leu, or fundamental code, during the continuance of that family; and to this, as supplementary clauses, are appended all the additional statutes, under the title of Lee. The earliest compilation of which any intelligence has been procured, is ascribed to a person of the name of Lee Quee, who is supposed to have lived about 250 years before Christ; and the greater part of the existing laws of China are conceived to be as ancient as that period. The present system of Chinese laws is called Ta-tsing-leu-lee, and takes its date from the year 1664, when the present Tartar dynasty of Ta tsin ascended the throne. The substance of this work has been translated into English by Sir George Staunton; and we may thus have a more thorough knowledge of the legislation of China, than of any other subject respecting that country, to which our enquiries can be directed. The laws also enter so minutely into every circumstance of private life, that a perusal of the work in question would afford a very complete view of the manners and customs of the Chinese people. For the sake of those, however, who may not have the opportunity or the wish to examine that large compilation, we may here insert a few of its principal enactments, as a specimen of its contents, and as the most authentic information on this branch of our subject.

These may be arranged under the following heads, viz. the different kinds and degrees of punishment authorised by the laws of China; the principal regulations, which they ordain in some of the most important and interesting cases; and the mode of administering those laws, in the apprehension and trial of delinquents.

Punishments.

In the time of Confucius, there were five sorts of punishments; viz. a black mark upon the forehead, amputation of the tip of the nose, amputation of the foot, or cutting of the ham-string, castration, and death. None of those punishments are mentioned in the code of the present dynasty; but those which are in common use, are,

1. The bastonade, which is inflicted by the pan-tse, or bamboo. This instrument is a lath of bamboo, about five or six feet in length, and four inches in breadth at the end which is applied to the offender, rounded at the sides, and polished at the extremity which is held in the hand of the executioner. It is generally applied in a severe and cruel manner, and it is seldom that a delinquent survives after receiving fifty blows. This instrument is in constant application, and is inflicted for the smallest offence. The more ordinary chastisements are not attended with disgrace, and are considered merely as a slight paternal correction. It is said to be frequently inflicted in this view, by the emperor himself, upon his courtiers and prime ministers, without their forfeiting his favour, or losing their respectability with the nation; and one officer may apply it to another of an inferior order, in a very summary manner, upon his failing in any duty, or even neglecting to salute his superior with pro-

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* Some of the Christian associations in Great Britain have recently turned their attention to the practicability of sending the sacred scriptures to the Chinese. In 1802, a note was sent by the Archbishop of Canterbury to "the Society for promoting Christian Knowledge," accompanied with a copy of a memoir by the Rev. W. Mosely, "on the importance and practicability of printing the sacred Scriptures in the Chinese language, and circulating them in that vast empire;" and, upon a motion by the Bishop of Durham, the matter was referred to the East India Mission Committee. The same idea had occurred to the British and Foreign Bible Society; and a young Chinese then residing in London, named Yong-saam-tak, had been employed by them in transcribing a Chinese translation of a harmony of the gospels, and most of the epistles, which had been found in the British museum; but it was discovered, upon examination, to have been made from the Vulgate, probably by some Jesuit, and the work was abandoned. This great object has since been undertaken, and in a great measure accomplished, by the Baptist missionaries in Bengal, with the assistance of a learned Chinese; whose important labours was noticed with just commendation by the present Governor-General in India, in the following impressive language: "I must not omit to commend the zealous and persevering labours of Mr Lassar, and of those learned and pious persons associated with him, who have accomplished for the future benefit, we may hope, of that immense and populous region, Chinese versions, in the Chinese character, of the gospels of Matthew, Mark, and Luke; throwing open that precious mine, with all its religious and moral treasure, to the largest associated population in the world." A similar attempt is making also by a Mr Morrison at Canton, who was sent to that station by the London Missionary Society; but, in the year 1809, he had still no prospect of being able to make his way to Pekin. In 1810, he had printed 1000 copies of the Acts of the Apostles, in the Chinese language and character; and, as he understood that the Gospels and Epistles were preparing at Calcutta, he had begun to translate the book of Genesis and the Psalms. He has lately published a work entitled *Horæ Sinicæ*, consisting chiefly of translations from the Chinese.

per respect. When it is inflicted in a court of justice, the presiding mandarin takes a small stick, about six inches in length, and one in breadth, out of a bag placed before him, and throws it upon the ground. The culprit is instantly seized by the attendants, and stretched upon his face on the earth, his clothes pulled down to his heels, and five smart blows applied to his posteriors; and, for every stick that the mandarin throws from his bag, five additional blows are inflicted. The offender must then throw himself upon his knees before the judge, incline his body to the ground, and give him thanks for the care which he takes of his morals: This is affirmed to be done even by the higher officers to their superiors. When women are subjected to this punishment, they are permitted to wear an upper and under garment, except in cases of adultery, when they are allowed only the under garment. It is said, that a Chinese, when undergoing the bamboo, cries out in a most piteous manner, and makes his acknowledgments afterwards with the utmost humiliation; but that a Tartar generally suffers in silence, grumbles against the executioner, and at length sullenly retires. In the case of mandarins, corporal chastisement may, in ordinary cases, be commuted for fine or degradation, or entire dismissal from the service of government.* The near relation, also, of a convicted offender, may put himself in the place of his friend, and undergo the legal punishment, provided that it be slight. It is affirmed, even that there are persons who make a trade of offering themselves as substitutes on these cases, and who are freely admitted by the judges. These persons contrive to escape without much injury, by sharing their pay with the executioner; as the actual offender also may do, when he submits in person, in the following manner: When the delinquent or substitute is stretched upon the earth, and the executioner ready to strike, he raises his fingers, in what number he thinks proper, each of them expressing a certain number of the smaller coins. The soldier understands the signal, appears to strike with all his force, but takes care to make the end of the bamboo touch the ground; and thus the sufferer, though he does not fail to utter loud cries to keep up the deception, retires without having sustained much injury.

2. The tcha, a kind of moveable pillory, is a wooden collar, composed of two flat pieces of timber, hollowed out in such a manner, that, when united together, there is room for a man's neck to be inclosed between them. This instrument is generally about three feet square, and six inches thick; and the ordinary weight is between 60 and 70 pounds; but this is increased according to the degree of guilt, and sometimes amounts to 200 pounds. When this machine is placed round the neck, and resting on the shoulders, the criminal is unable to see his feet, or to put his hands to his mouth, and would die of hunger if he had no person to administer his food. There is always a paper attached to this collar, expressing the crime and penalty of the wearer; and he is not permitted to conceal himself at home, or in retired situations, but is condemned to appear a given time every day in some public square, street, gate, temple, or tribunal. It is worn night and day, and the offenders can be relieved from the weight only by leaning the corner or side of it upon the ground; but sometimes they are seen provided with a bamboo chair, the sides or posts of which are raised so high as to support the tcha, without allowing it to touch the shoulder. There is still, however, no rest found for the head; and this situation is prolonged for weeks, or months, according to the nature of the crime. At the expiration of the assigned period, the culprit must present himself before the judge, who relieves him from his load, exhorts him to amendment, and dismisses him with a slight chastisement from the bamboo.

3. Banishment to different distances for different periods, or to the regions of Tartary for life; and persons suffering this sentence are obliged to wear a red cap. The children, grandchildren, and wives of an exile, are permitted to follow him to his place of residence.

4. Dragging the imperial barks for a certain number of years, and within a certain range, 200, 250, or 300 leagues, according to the degree of delinquency. This punishment is not very frequent, perhaps, because a certain number of persons only is required for the purpose, and a multitude of culprits would too much diminish the labour.

5. Death by strangling or beheading. The former punishment is not inflicted by suspension, as in Europe, but a running noose is put round the neck of the criminal, and two attendants pull the cords in different directions, with all their might, suddenly quit their hold for a moment, then give a second pull, which generally completes the business; or, the criminal is tied upright to a cross, a rope passed about his neck, and twisted strongly behind by means of a stick, or bow, in the hand of the executioner. The latter punishment, that of beheading, is accounted the most infamous; and as the Chinese consider the loss of any member, with which they have been born, as one of the greatest misfortunes, they have a peculiar horror of suffering decapitation, and of thus dying in a mutilated state, deprived of the noblest part of the body. Sometimes the head of the criminal, especially of an assassin, is exposed in a cage suspended from a post erected at the side of the high way. Persons guilty of high treason, are put to death by a slow and painful execution; and, though it is sometimes specified, that this shall be done by opening the belly of the criminal, and then cutting his body into several pieces, yet it is permitted to the executioner, in general, to aggravate and prolong the sufferings of the condemned, by any species of cruelty which he may choose to inflict. In cases of capital punishment, the sentence cannot be executed till the emperor has examined and confirmed the process. When the crime is of an atrocious nature, the execution is ordered to take place without delay; but, in general, it is postponed till the season of autumn, when all the sentences of death are inflicted throughout the empire. Before any offender is put to death, a meal is set before him; and he may be conveyed to the fatal spot by a chair, or carriage, if he has the means to procure it. His mouth is gagged, and the judges are present at the execution. In some rare cases, the sentence of death may be redeemed by a sum of money, from L. 400 to L. 4000, according to the rank and ability of the offender. Persons below ten, and above eighty years of age, when guilty of a capital offence, are recommended to the emperor's clemency; and no one below seven, or above ninety, is made to suffer death for any crime except high treason.

Torture.

In cases of great moment, the accused are authorised to be put to the torture, in order to extort confession;

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* In the case of persons under fifteen, or above seventy years of age at the time of their trial, whatever may have been their age at the time of committing the offence, corporal punishment may be redeemed, at the rate of about thirty shillings a blow.

and this is applied to the hands or to the feet. The former is inflicted by means of round pieces of wood, about an inch thick and a foot long, which are placed between the fingers, and drawn together at the extremities, in such a manner as to dislocate the joints. The latter is done with three pieces of wood, one of which remains fixed, and is put between the two ankles; the other two are moveable, about three feet in length, and six inches wide, fastened together at one extremity by a hook, and pulled close at the other end, by means of cords passing through holes, with such force as to render the ankle joints flat. These racks are understood to be extremely painful; and yet it is affirmed, that, by means of proper applications, persons who have undergone the latter operation, were often enabled to walk again without difficulty. A still more dreadful kind of torture is mentioned, which consists in making small gashes in the body, and then tearing off the skin in the form of thongs: It is sometimes used in cases of treason, or other atrocious crimes, when the guilt of the sufferer is clear, and when it is wished to make him discover his accomplices; but in these cases, it seems to come rather under the denomination of capital punishment, as already described. Torture cannot be inflicted upon the eight higher orders of princes and officers, upon persons under fifteen or above seventy years of age, or upon those who labour under any permanent infirmity or disease.

The scale of punishment consists of five divisions, in each of which there are various gradations.

1st, From 10 to 50 blows of the bamboo.

2d, From 60 to 100 blows.

3d, Temporary banishment to a distance not exceeding 500 lee, or 150 miles, extending from one to three years, and accompanied with a corporal punishment from 60 to 100 blows.

4th, Perpetual banishment to the distance of 2000 or 3000 lee, with the additional punishment of 100 blows; and,

5th, Death by strangulation, decollation, or torture.

Specimens of laws.

Treason.

1. These laws are particularly severe with respect to all offences committed against the sovereign; and his life and authority are guarded by the most minute and cautious regulations. Persons, convicted of treasonable practices, are to be put to death by slow and painful tortures; all their male relations, in the first degree, indiscriminately beheaded, their female relations sold into slavery, and all their connections, residing within their household, relentlessly put to death. To intrude even into the line of the imperial retinue, while the emperor is travelling, or to enter any of the apartments in the palace, actually occupied by himself or his family, is punishable with death. Nay, to walk or ride upon the road and bridges, along which the emperor is to pass, exposes the offender to severe punishment. All the workmen employed about the grounds and buildings in the palace, have their names inserted in a list as they go in and come out; are provided with passports as they enter the gates, which they must deliver back at their return; are regularly counted, as they pass and repass; and, if any one remains behind, he is subject to a capital punishment. If the emperor's physician compound any medicine for the use of the sovereign, in a manner which is not sanctioned by established usage, he is subject to the punishment of 100 blows. If any dirt is found in his majesty's food, the cook is condemned to receive 80 blows; if he sends up any dish, which he has not previously tasted, he receives 50 blows; if he has mixed any unusual ingredient in the food, he is liable to 100 blows, and is compelled to swallow the article himself.

Homicide and murder.

2. The life of man is held peculiarly sacred; and, except in the case of exposing infants, murder is never overlooked. Murder by design is punished by beheading. Administering poison is a capital crime, though the dose should not occasion death. Killing in an affray is also punished with death. Homicide, or even wounding by accident, is still punishable with death; but the offender may in this case redeem himself from the capital part of the sentence, by paying a fine to the relations of the sufferer, to defray the expence of his funeral. The mere attempt or design to commit parricide is punished by beheading; and the actual perpetration of this crime, by death with torture. A practitioner in medicine, performing any operation, or administering any medicines, in a manner contrary to the established rules and practice, and thereby occasioning the death of his patient, is considered as guilty of homicide; but if, upon examination, it appears to have been simply an error, he may redeem his life by a fine, upon the condition that he quit his profession for ever. To kill another in revenge for the slaughter of a parent is punishable only by 100 blows; and husbands are permitted to kill persons taken in adultery. In cases of assault, a multitude of nice distinctions are made, according to the degree of pain or injury inflicted; the rank and connection of the parties; and the degree of provocation given and received. Persons inflicting wounds are liable for their consequences, 20, 30, or 50 days, according to the nature of the injury; but, after the legal period is expired, the assailant is no longer responsible, even though the death of the other party should ensue. To strike a father, mother, grandfather, or grandmother, is punishable by beheading; and should a wife strike her husband's relations in any of these degrees, she is punished as if they were her own. Should she strike her husband, she is punished by three degrees more severely than for a common assault; if she maim him, she is put to death; and if he die in consequence, she is executed by torture. A slave, striking a free man, suffers only one degree more severely, than in the case of assault between equals, and *vice versa*. A master may strike his slave with impunity, provided it be for correction, and that the blow does not cut. A parent, chastising his child so as to occasion death, is punishable only by 100 blows; and no statute whatever exists against infanticide. Anonymous accusations are punished with death, even although they should prove true; and false and malicious accusations subject the offender to a penalty, two degrees more severe than the accused would have undergone, had the charge been proved.

Theft.

3. Theft, merely attempted, is punished with 50 blows; if actually committed, by a punishment from 60 blows, to 100 blows, or to death, in proportion to the value stolen; and, if against relations, or connections by marriage, the penalty is five degrees less than in ordinary cases; because all the members of a family are considered as having a joint interest in their property, so that the domestic thief takes what is partly his own. Swindling is punished by the same degrees as theft to the same amount; but, if the money was extorted by threats, the penalty is one degree more severe, than in ordinary cases of theft. Kidnapping and selling free persons as slaves, is punished with 100 blows and perpetual banishment; but, if force was used and wounds inflicted, by death. An attempt to rob in a body is punished with perpetual banishment. A single person, taking openly and by force the property of another, suffers 100 blows, and three years banishment; but, if the plundered individual be wounded, the penalty is death. Robbery during the night is punished with death; entering a dwelling-house

under night, by force or stealth, incurs a penalty of 80 blows; and the master of the house is justified in killing the person while he is entering, but not after he has succeeded in seizing him. Combinations to raise the price of commodities, are punished with 40 blows; and the use of false weights and measures, with 70.

Adultery.

4. Fornication and certain detestable crimes are punished with 70 blows; adultery with 100 blows, but more severely if committed by persons high in office; and rape subjects the offender to death by strangulation, while the attempt itself is punished with 100 blows, and perpetual banishment.

Fire-raising.

5. Wilful fire-raising in a person's own house, is punished with 100 blows; in the house of another, by death. Accidentally firing one's own house incurs a penalty of 40 blows; but, should the fire spread to the gate of an imperial palace, death is the consequence.

Forgery.

6. Forging an imperial edict, or counterfeiting the current coin of the empire, is punished with death; but there appears no precise regulation about the forgery of private writings.

Bribery.

7. Bribery is punished in different degrees, according as the sum is large or small, and the object innocent or criminal; and the penalties vary from 60 blows to death, which last is incurred by taking 80 ounces of silver (about £26.) for an unlawful purpose, or 120 ounces (£40.) for a lawful object. Offering or giving a bribe is punished less severely than accepting; and agreeing to accept is punished as if actually taken; but, when it is asked or extorted by an officer of government, the giver is not punishable at all.

Peculation of public money.

8. Very strict regulations are enacted for accurately keeping and auditing the public accounts, and for preventing the embezzlement of the public money. In all cases of defrauding the public, restitution is an indispensable obligation, independent of the prescribed punishment. Privately lending or employing the government money, is punished as theft according to the amount; and actual peculation, to the amount of 1000 ounces of silver, is punishable with death. The revenue officers are reciprocally answerable for each other; but it is rather strangely enacted, in all cases of officers under government, associated in one department, and committing offences against the laws as a public body, by false or erroneous decisions, that the clerk of the department shall be punished as the principal offender, the deputies, or executive officers, one degree less, the assessors another degree less, and the presiding magistrate less by a third degree.

Smuggling.

9. Smuggling is punished nearly as in Great Britain, but the penalties are rather milder. The carriage, boat, or horses, by which the unlicensed goods are transported, are forfeited as with us; but the offender forfeits only one half of the goods, three-tenths going to the informer; and the personal pains are moderate.

Marriage.

Divorce.

10. The regulations on the subject of marriage are remarkably full and precise. Almost every man is married as soon as he is of age; and the contract, in the case of a first and legal wife, is always concluded between the parents or relations of the parties, totally independent of their consent. After this, the husband may espouse other wives, or concubines, or handmaids, or by whatever other name he may choose to call them, without consulting his friends or observing any ceremony; but these inferior wives, though equal in rank among themselves, are all subordinate to the first wife. Persons bearing the same family name, though no way related to each other, are strictly prohibited from intermarrying; but even relations, beyond the fourth degree, may marry without any censure. Whoever marries, while his or her parents are in prison charged with a capital offence, incurs a penalty of eighty blows, unless the marriage has been consummated by the desire of the parents themselves, and the usual entertainments omitted. If a husband degrades his first wife to the condition of an inferior wife, he is liable to a punishment of 100 blows; if, in the lifetime of his first wife, he raises an inferior wife to the condition of a first wife, he is punished with ninety blows; and, in both cases, the wives are replaced in their former situations. If the wife commits adultery, the husband not only may, but must put her away, otherwise he would suffer a punishment of eighty blows; and, if he should repudiate a first wife, without a sufficient legal cause, he is punished in every case, with eighty blows. The justifying causes of divorce, besides adultery, are; barrenness, lasciviousness, disregard of the husband's parents, talkativeness, thievish propensities, envious and suspicious temper, inveterate infirmity; yet, if any of the three reasons against a divorce should exist, if the wife has mourned three years for her husband's parents, if the family have become rich, after having been poor previous to and at the time of marriage, or if the wife have no parents living to receive her back again; then none of the seven aforementioned causes will justify a divorce; and the husband, who puts away his wife upon such grounds, shall suffer punishment, two degrees less, than that last stated, and be compelled to receive her again. If a wife withdraws herself privately from her family, the husband may treat her as no longer his wife, but his slave, whom he may keep or sell to another in that capacity. If a husband absents himself three years from his wife, she may lay her case before the mandarins, and will then be permitted to take another husband.

Inheritance of property.

11. With respect to inheritance, it appears, that land cannot be disposed of by will contrary to the regulations of the law, which require the heirs to share it amongst them in certain established proportions. A son is always a minor during the life of his father, and whatever he inherits or acquires is entirely at his father's disposal; while he, on the other hand, is liable for his father's debts, except those incurred by gaming. Women are excluded from inheriting or disposing of property when there are children; but when there are no sons, a man may leave his whole property by will to his widow. The reasons given for not permitting females to inherit is, that a woman can make no offering to deceased relations in the hall of ancestors; and it is deemed one of the first blessings of a man's life to leave some descendant who can transmit his name to posterity at this public solemnity.

Debtors.

12. It does not appear that a creditor can attach the person of a debtor; but, upon a complaint being presented to a mandarin, he commands the goods of the debtor to be seized and payment to be made; or, if he has no substance to procure his discharge, he receives thirty blows, and a month's delay to make payment; and so on, at the rate generally of thirty blows per month, till he satisfy his creditor. Hence every possible exertion is made to discharge the claim; and sometimes the debtor gives himself up as a slave, when he has no other means of extricating himself from his difficulties. Though the law punishes with eighty blows every creditor, who should attempt to pay himself, by a violent seizure of what belonged to the person, who was indebted to him, yet certain modes of teazing the creditor at the commencement of the year are tolerated by the mandarins, and are generally accompanied with success. On the first day of the year, creditors enter the houses of their debtors,

announcing their claims with a loud voice, and continuing to keep their station, till they be reimbursed; and, as the debtor knows, that, should any accident happen to his creditor in such circumstances, he would be punished upon suspicion of having attempted his life, hence these visits are greatly dreaded, and are terminated if possible by actual payment, or by some compromise for the satisfaction of the claimant. Another, and generally a last resource, is to threaten to carry off the door of the debtor's house or shop, on the first day of the year, which is accounted the greatest misfortune, that could happen at such a time, as there would then be no obstruction to the entrance of the evil genii. As such charges for debt are accounted highly infamous among the Chinese, the friends and relatives of the party involved are ready to come forward with their mediation, to prevent matters from coming to such extremities; but, when a debtor is conscious of having no resource, it is no uncommon expedient, in order to avoid these inauspicious visits of his creditor, to set fire to his own house at the end of the year.

Private offences.

13. The laws interfere in every circumstance of human conduct, and penalties are incurred by the most private domestic improprieties, such as neglecting to honour the tombs of deceased parents, dressing unsuitably, allowing lands in possession to lie waste, neglecting to pay interest regularly for debts or borrowed money.

Forms of process, &c.

In matters of police, the process is very summary, especially if the mandarin has been a witness of the offence. He does not wait till a complaint be made, nor does he send the person apprehended to prison, to be brought afterwards to trial; but instantly interrogates, judges, and punishes him, upon the spot. When an individual has sustained any injury, he states his grievance to the mandarin of his district or village, who is ordained to administer justice without any fee or present, and who is forbidden to drink wine before going to the tribunal; and it is permitted to the subject, in every instance, to apply to the highest magistrate within his reach, to the governor of the city, or the viceroy of the province in which he resides. If the mandarin admits the charge, he puts upon it a red mark, which then converts it into a warrant for execution. In complicated cases, the trial is carried on in public and by writing, witnesses are examined, the parties heard, and the judge explains the ground of his sentence. No advocate or counsel is permitted, but every one pleads his own cause, either *viva voce*, or by memorial; and should any third person interfere in a cause, so as to give it an unjust issue, he would be subjected to severe punishment, according to the nature of the case. In criminal cases, the witnesses are confronted, and also separately examined; all possible means are used to reach the truth, and the whole process is committed to writing. If it is a matter of life and death, it is remitted to the tribunals at Pekin, where the whole is revised, and confirmed or altered, as they may see cause. But, in civil causes, the power of the superior magistrate in the place is absolute; and his decision without appeal, unless the matter be considered of sufficient importance to be transmitted to the capital. All persons, who come to the knowledge of a crime, and fail to inform, are liable to punishment; but whoever should inform against his father, mother, grandfather, grandmother, uncle, or elder brother, is condemned to suffer 100 blows, and to be banished for three years, even though the accusation should be just. In cases of theft and robbery, the mandarins and soldiers of the district are exposed to repeated floggings, or to dismissal from their office, if they fail to discover and convict the offender. If any one comes before a magistrate, and freely confesses his crime before he has been charged with it, he is entitled to a free pardon, provided it be the first offence. When once a person is apprehended upon any charge or suspicion, he is carried to prison without any relief, analogous to bail; except in the case of female offenders, who are not committed to prison, unless for capital crimes or adultery, but are permitted to remain with their husbands or relatives, till the day of trial.

Prisons.

There are prisons in every city of consequence, which are said to be large, commodious, and in excellent order. They are surrounded with high walls, in which are lodgings for the soldiers; and have large courts, where the prisoners are allowed to walk during the day. As their allowance of rice from the government is small, they are permitted to work for their support, and hence the prisons are provided with workshops, and the necessary articles of the different professions. In the larger prisons, merchants, tailors, butchers, and cook-shops, are to be found for the use of the persons confined; and, if the prisoners possess money, and have been guilty of slight faults, they can procure separate cells and good treatment. Their relations are allowed to visit them in prison, and are even encouraged to afford them every assistance and comfort in their power. The debtors and felons are always kept in separate apartments; and the latter are neither allowed to go out, nor to speak to any person. They bear a piece of wood upon their neck, upon which is written their name, crime, and sentence. They may be allowed to work, and to enjoy some little ease during the day; but are strictly treated during night, lest they should effect their escape, for which the soldiers would be held strictly responsible. They are then stretched upon planks of wood; tied down by large chains on their feet, hands, and body, stowed close to each other, so that they can scarcely stir; and are even covered above with large tables of timber. The women, also, are separated from the men, and can be seen and spoken to only through a grate or the turning-box, by which their food is conveyed. A mandarin is appointed to inspect frequently these places of confinement; and is bound to see, that the sick be properly treated, provided with medicines, and attended by a physician, at the expence of the emperor. Upon the death of a prisoner, the emperor must be immediately informed, and he sometimes commissions a higher mandarin to enquire how far the inspecting officer has done his duty. The body of a deceased prisoner is not carried out by the ordinary gate, but by a hole in the wall, made for the purpose, which is accounted one of the most infamous occurrences in the life of a Chinese; and one of their heaviest imprecations upon another, is to wish, that he may be carried through the hole. Hence, when a person, possessed of any property or station, falls sick in prison, his relations use all means to procure his dismissal till cured, that, in case of his dying, he may thus avoid the fate of being carried through the wall.

Character of their laws.

These laws are expressed in a style distinguished for its brevity, distinctness, and simplicity, yet sufficiently copious and full, so as to put it in the power of every subject, who peruses them, to understand the will of the legislature. The characteristic defect of the whole system is an unprofitable minuteness of regulation, an intolerable interference with every ordinary duty of life, and an unnecessary endeavour to fix every shade of distinction, which a case may receive from its circumstances. Thus, indeed, nothing whatever is left to the discretion of the judge, and every offender may almost anticipate his sentence; but the system is completely destructive of personal freedom, and resembles more the irksome discipline of a school, than the judicious restraints of an enlightened government. It is sufficiently adapted to keep subjects in order, and to repress private injuries among individuals; but it is a dead weight upon every thing like dignity of mind or delicacy of feeling, and would be felt as the most cruel oppression by a high-spirited and generous-minded people. The formation of such a code seems to belong to a state of society, not much advanced beyond the first stages of civilization, and its direct tendency evidently is to prevent the people, under its influence, from making any farther progress in the political improvement of their condition, or in personal refinement of character. The indiscriminate frequency of corporal punishment must infallibly prevent such attainments, and fixes the subjects always in the condition of grown children, who are kept in order by mere flogging. Offences of all descriptions, and in every rank of society, are punished by a certain quantity of flagellation; and there are at least 50 clauses in this code of laws, by which a general officer is ordered to receive, for particular offences, 50 lashes upon his posteriors; while he is allowed to continue in the command of the army. Such a system of whipping men into good morals and civil manners may be adapted to the peculiar genius of the people among whom it prevails; but it could never have originated, nor have continued to be endured, except in a country where there existed, in an extreme degree, a general debasement of all character. The severity of these corporal punishments is not so great as the law prescribes; and in the published code, we see rather the measure and scale of punishment, than the actual execution and practice. Thus, 10 blows of nominal punishment are reduced to four in reality, and 100 to 40. It is found, however, to depend much upon the administrators of these laws, whether they can be called lenient or severe; and it seems to be the concurrent testimony of eye-witnesses, that the latter character is the more general. "The manner," says M. De Guignes, "in which I have seen the bamboo applied during my journey is cruel." "In our return down the Pei-ho," says Mr Barrow, "the water being considerably shallower, than when we first sailed up this river, one of our accommodation barges got aground in the middle of the night. The air was piercing cold, and the poor creatures, belonging to the vessel, were busy until sun-rise in the midst of the river, using their endeavours to get her off. The rest of the fleet had proceeded, and the patience of the superintending officer at length being exhausted, he ordered his soldiers to flog the captain and the whole crew, which was accordingly done in a most unmerciful manner; and this was their only reward for the use of the yacht, their time, and labour for two days. Whenever the wind was contrary, or it was found necessary to track the vessels against the stream, a number of men were employed for this purpose. The poor creatures were always pressed into this disagreeable and laborious service, for which they were to receive about 6d. a day so long as they tracked, without any allowance being made to them for returning to the place from whence they were forced. These people, knowing the difficulty there was of getting others to supply their places, and that their services would be required until such should be procured, generally deserted by night, disregarding their pay. In order to procure others, the officers dispatched their soldiers to the nearest village, taking the inhabitants by surprise, and forcing them out of their beds to join the yachts. Scarcely a night occurred, in which some poor wretches did not suffer the lashes of the soldiers for attempting to escape, and for pleading the excuse of old age and infirmity. It was painful to behold the deplorable condition of some of these creatures. Several were half naked, and appeared to be wasting and languishing for want of food. Yet the task of dragging along the vessels was not light. Sometimes they were under the necessity of wading to the middle in mud; sometimes to swim across creeks, and immediately afterwards to expose their naked bodies to a scorching sun; and they were always driven by a soldier, or the lictor of some petty police officer, carrying in his hand an enormous whip, with which he lashed them with as little reluctance, as if they had been a team of horses." Nor is it merely the lower and poorer classes, who are thus subjected to the caprice, cruelty, and extortions of the mandarins; but even persons of property have no sufficient security or proper influence in this country, and are even still more frequently made objects of plunder to those in power. Hence a rich man in China, instead of deriving benefit or comfort from his wealth, is often afraid to use it, or at least to show that he is using it; and is very cautious not to indicate his circumstances by having a fine house, or wearing finer clothes than his neighbours, lest he should attract the notice of the governor of his district, who would soon find means to bring him under some sumptuary law, and thus to fleece him of his wealth. Thus it is always found in China, that the man in office has it in his power to govern the laws; and though the utmost solicitude is expressed by the imperial edicts, and the most severe restrictions enacted, with a view to prevent the negligence, corruption, and oppressions of the judges and officers, yet these are very generally disregarded by those who should most observe them; and there is scarcely a more profligate and oppressive government in the world, than that of the Chinese. Of one crime at least, and that one of the most heavily reprobated by their laws, they are known to be almost universally guilty, namely, that of corruption; and wherever this evil is so extensive, it is evident that the foundation of all justice and good government must be completely subverted. At Canton, it is believed that the British traders have never yet met with any officer of government, who was inaccessible to a bribe; and a very remarkable instance is recorded by Sir G. Staunton, in the appendix to his translation of their penal code, which will convey the best idea of the corrupt chicanery and barefaced falsifications which are common in Chinese tribunals of justice.

Instance of Chinese justice.

In February 1807, 52 seamen belonging to the East India Company's ship Neptune, having been on shore at Canton, had been involved in a general scuffle with some hundreds of Chinese, when one of the latter received an unfortunate blow with a stick, in consequence of which he soon after died. The Chinese merchant, who had become surety for the good behaviour of the crew, being called upon by the mandarins, applied to the British factory to deliver up the offender, or at least one of the seamen engaged in the affray. As it was impossible, however, to ascertain which of the ship's company, or whether any of them had given the blow, the supercargoes resisted the demand. The chief of the factory was threatened with imprisonment, until a man should be given up; the cargoes for the Company's ships were withheld; and the security-merchant was actually put in chains, and menaced with corporal punishment. As these measures did not succeed, the magistrates next demanded, that those seamen who were most active, who carried sticks, or who were known to be drunk at the

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time of the encounter, should be examined by torture. This demand was of course also rejected; and, after a month spent in threats, proclamations, and daily conferences on the subject, the security-merchant was allowed to send his agent to all the ships in the river, offering a reward of 20,000 dollars to any person who should give information of the individual who had struck the deceased. This temptation, great as it was, had no influence upon any of the British seamen, and at length the Chinese judges agreed to attend at the British factory, and to examine the 52 men in the ordinary way. Of these they selected eleven as having been the most active in the scuffle, and endeavoured to prevail upon some one of them to plead guilty, under an implied promise of a pardon. This expedient also failing, it was next suggested that the whole affair might be got over, if the officers of the Neptune would depose, that they had seen a sailor carrying a bamboo stick over his shoulder, against which, in the hurry and confusion, a Chinese had accidentally struck his head. This ridiculous proposal being treated with deserved contempt, it was next proposed, that one of the sailors should be prevailed upon to state, that finding an attempt made upon his pocket, he had struck behind him, and might thus have wounded the deceased. Still meeting with no better success, they proceeded in their examination, and dismissed all the seamen except two, Julius Cæsar, and Edward Sheen. It appeared, that Julius Cæsar had a small cane in his hand on the day of riot, but was not on the outside of the factory; and that Edward Sheen was on the outside of the factory, but did not carry a stick. He confessed, however, that he had a Chinese tobacco pipe in his hand, the tube of which was of bamboo; and the court therefore decided, that he carried a stick, and consequently was the culprit. A long negociation then took place as to the disposal of Edward Sheen, till the final decision upon the case should be received from Pekin; and it was at length agreed, that he should be left behind in charge of the supercargoes. The following is the representation, which was made of the case to the supreme court at Pekin, and its decision upon the matter. The viceroy of Canton states, for the information of the supreme court, that Edward Sheen, an Englishman, being in an upper story of a warehouse, which overlooked the street, and in which there was a window opening with wooden shutters, did, on the 18th day of the 1st moon, employ a wooden stick in an oblique direction to keep open the shutter, and that, in doing this, the wooden stick slipped and fell downwards; that *Leao-a-teng* a Chinese, passing at the moment, was struck and wounded by the falling of the said stick upon his left temple; and that, on the evening of the following day, he died in consequence of the wound; that repeated orders had been given to the chief of the British factory to deliver up the man to justice; that in reply it was alleged, the said criminal was sick of an ague and fever, and under medical treatment; that, on his recovery, he was confronted with the relations of the deceased; that, after repeated examinations, the said Edward Sheen had acknowledged the truth of all the facts here stated, without reservation; that he had consequently been proved guilty of accidental homicide, and ought therefore to be sentenced to pay the usual fine, to redeem himself from the punishment of death by strangulation. Upon this report, the supreme court observes, "that the case appears to be one of those acts, of the consequence of which neither sight, hearing, nor reflection, could have given a previous warning; that the said Edward Sheen should therefore

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be allowed to redeem himself from the punishment of death by strangulation, by the payment of a fine (amounting to about L. 4, 3s.) to the relations of the deceased, to defray the expences of burial, and then be dismissed to be governed in an orderly manner in his own country." This gross fabrication of a story, in mockery of justice, the acquiescence of the different parties interested in the business, and the promulgation of such falsehoods in the face of thousands, who could have contradicted them, was all procured at the expence of the security-merchant, by the division of a bribe of nearly L. 50,000.

Revenue.

The revenues of the Chinese government have been very variously stated by different authors: and, as the natives are all possessed with a most extravagant idea of the greatness of their country, they communicate to strangers their own wide conjectures rather than exact statements on the subject. Hence an inquirer generally receives as many different accounts, as he consults different persons. According to a rough sketch of the sums raised in each province, communicated to Lord Macartney by a Chinese minister, the total annual amount is about sixty millions sterling, of which, after defraying the ordinary civil and military expences, about twelve millions are supposed to remain for the emperor's private establishment. But, as it was clearly the great object of the Chinese rulers to impress the British embassy with the most exalted notion of the strength and resources of their empire, these accounts may be imagined to have been considerably exaggerated. The calculations of M. De Guignes scarcely amount to one half of the Chinese statements to Lord Macartney; and he considers it as next to impossible to ascertain the exact truth on this subject, because the Chinese contradict one another even in their own expositions of the matter, because they are all inclined to exaggerate in their accounts to foreigners, and because, even in writing for the information of their own countrymen, they dare not advance any conjectures or details, which would be prejudicial to the credit of the mandarins, whose honour and interest depend upon the real or pretended prosperity of the empire.

The revenues formerly arose from a capitation tax, which was changed by the emperor Yong-tching into a land-tax with respect to the proprietors or cultivators of the soil; while it appears that the merchants, artizans, and others not employed in husbandry, are subject to a similar assessment upon their shops or warehouses. The land tax is one-tenth of the produce, or rather of the profit, after deducting the expences of cultivation. The lands are carefully registered, and their fertility estimated. Great precautions are used, that neither the occupant be overcharged, nor the government defrauded; and in those districts which have severely suffered from drought or inundations, the emperor, if in any degree desirous of popularity, generally remits the public burdens. In the rice districts of the south, especially the provinces of Quang tong and Quang-see, there is a second tenth raised upon rice, because two crops of that grain are produced in one season. There is farther an excise upon salt, coal, and almost every kind of merchandise; and a duty upon the manufacture of silks and other stuffs. The regulations on this branch of the revenue bear a most striking resemblance to those of Europe; and there is in China a system of permits, excise-officers, licenses to traders, and penalties upon smugglers, almost exactly the same as what is practised in Great Britain. The taxes in general, as far as they affect the great body of the people, may be considered as extremely moderate; and it has been calculated, that, exclusive of the husbandmen, the other classes of the community are not assessed with more than four shillings each. For the collecting of these revenues there are assessors and valuators in every district, who are responsible for its quota in land produce; receivers of the duties upon shops, &c. in the cities; and custom-houses, with their proper officers, in every principal town. At these custom-houses, no interruption is given to travellers for the purpose of searching their baggage and requiring a fee, except at Wampoo and Canton, where the custom-house officers are said to be most irritating and insolent in their investigations of every foreigner's effects. The merchant pays the duties by the piece or weight; and in the former case, the collectors generally depend upon the statements given in his own books. The land-tax is paid partly in kind and partly in money, in the proportion of nearly one half in each. The amount collected in villages and towns is conveyed to cities of the third class; the amount of these to cities of the second; and the amount of these again to cities of the first. From the revenues of each province the civil and military officers are paid in the first instance, chiefly in kind; a certain portion is then reserved, in the public granaries of each city or district, for incidental expences; and the surplus is either transported in kind, or sold for money, which is remitted to the imperial treasury at Pekin, for the use of the court and the establishments of the emperor. A statement of what is collected in the several provinces, of what is reserved in the different cities, and of what is paid into the treasury, is laid before the tribunal of finances, which revises the whole, and keeps an account of all that is expended. Besides these ordinary revenues, additional assessments are sometimes levied, especially in cases of insurrection, when the neighbouring provinces are generally required to contribute the expences of its suppression.

The surplus of the general revenue, after all the expences of the state have been defrayed, belongs to the emperor, who may indeed appropriate to himself what portion he pleases; but it is understood to be usually deposited in the national treasury, as a fund for defraying any extraordinary expenditure, without imposing farther assessments upon the people. The emperor always receives from the general stock, the necessary quantity of rice and other provisions, of silk and other articles, for his household and attendants, consisting of mandarins, eunuchs, servants of the palace, and Tartar bands, who are calculated altogether at a number not less than 100,000. Besides what he may draw for this purpose from the general revenues, his privy purse is supplied by the whole profit of the trade in Ginseng, confiscations, seizures, presents from the principal mandarins, and patriotic gifts from his subjects, in porcelain, tea, silks, &c. which are all pompously proclaimed in the Pekin Gazette, and which afterwards serve as presents to foreign ambassadors and favourites. The emperor possesses also very extensive domains, along that part of the great wall, which is nearest to the metropolis, the rents or produce of which belong wholly to himself and his family; and, besides these lands, he maintains large flocks and herds beyond the great wall, in the regions of Tartary, which are all converted into money for his use. The amount of his private revenue from these different sources cannot be exactly ascertained, but has been estimated at 100,000,000 of French livres, or about L. 4,444,444 sterling. The following view of the gross sum of the revenues and expences of the Chinese government is founded upon the calculations of M. De Guignes; into the grounds of which, however, we have not room to enter, but present our readers merely with the general results.

Revenues.

	French livres.	Sterling
One half of the land-tax in money, according to an Imperial edict in 1777	206,955,000	
Value of the other half collected in kind	206,955,000	
Additional land-tax upon the southern rice districts	161,320,000	
Duties upon salt, coal, &c.	48,047,670	
Duties upon silk and other manufactures	50,722,330	
Capitation tax upon merchants, artisans, &c.	30,000,000	
Duties upon foreign trade at Canton	6,000,000	
	710,000,000 or	£31,555,554

Expenditure.

	French livres.	
Salaries of mandarins civil and military, whether superior or subordinate	57,500,000	
Expence of 600,000 infantry, at 3 taels per month, one half money, and the other half provisions	162,000,000	
Expence of 242,000 cavalry at 4 taels per month	87,120,000	
Expence of the waste of horses, in the proportion of one for every ten, at 20 taels each	3,630,000	
Uniforms for 842,000 soldiers, at 4 taels each	25,260,000	
Arms, &c. for 842,000 soldiers, at one tael each	6,315,000	
Marine, and boats	100,000,000	
Canals	30,000,000	
Forts and artillery	28,175,000	
	500,000,000 or	£22,222,221

	French livres.	
Amount of revenues	710,000,000 or	£31,555,555
Amount of expenditure	500,000,000 or	£22 222 222
Surplus	210,000,000 or	£9,333,333

This surplus is deposited in the public treasury after the emperor has taken from it what he finds necessary, or thinks proper for his own expences. But, though he possesses also a revenue of his own, calculated at 100,000,000 French livres or £4,444,444 sterling, yet it would not seem, that he has much wealth at command; as it appears, that he was recently under the necessity of accepting an offering of 500,000 taels or ounces of silver, £166,666 sterling, from the salt merchants of Canton, and of selling a quantity of his precious stones, in order to defray the unexpected charges occasioned to the government, by an insurrection in the western provinces.

ARMY.

Amount of forces.

According to the statements of the Chinese government to Lord Macartney, the amount of their standing army, even in times of peace, is immense, namely, one million of infantry, and eight hundred thousand cavalry; and, according to a calculation made by his lordship, from the information of the officers, the annual pay and expences of this force could not be less than L. 49,982,933 sterling. These statements, however, M. De Guignes positively affirms to have been greatly exaggerated by the Chinese mandarins, in order to give the embassy a higher idea of their power; and in this view, he adds, that the number of military seen by the British in the different places through which they passed, had been purposely collected from a distance, and placed upon their route. The Dutch embassy, which he accompanied, perceived nothing in the whole of their progress, which served to indicate such a multitude of soldiery. They never met upon their route a single corps, either of infantry or cavalry, in motion. They found only about 40 soldiers at the entrance of cities of the third class, about 200 in those of the second, and from 1000 to 2000 in those of the first. Even at Pekin they saw only two miserable companies of guards at the gates of the palace, a few of the emperor's guards in his gardens of Yuen-ming-yuen, and a small number of soldiers on the day of their last audience. M. Van Braam expressly declares, that he never saw, in all his progress through the capital, more than a guard of six soldiers together; and, during his visit, he did not observe a regular guard even at the gate of the palace. "We passed, and halted," says M. De Guignes, "in the same places as the English; but the number of soldiers, stationed on purpose on their line of progress, was no where seen by us. Every one had returned to his post, and we found only the ordinary number." According to the calculations of different missionaries, the whole of the forces throughout the empire do not exceed 800,000; and the Chinese assured M. De Guignes, that there was not more than 20,000 or 25,000 troops in each province. Upon these grounds, he calculates the whole of the Chinese standing army at 842,000 men, of which number 240,000 are cavalry.

Condition of the soldiery.

As the empire of China enjoys a state of profound peace with its neighbours, of whom there is none sufficiently powerful to endanger its repose, the condition of a soldier in this country is not attended with much danger or fatigue, and is generally very much desired by the natives. Those who enlist are enrolled in the provinces where they are born, or reside; and the corps, to which they are attached, never change their station. Hence the greater part of the army is a kind of fixed militia, never moved from their homes, and even rarely called into service. All the Tartars are considered as soldiers from their birth, and begin very early to receive pay. The father of a numerous family, an only son, or the son of an aged widow, are exempted from military service, except in cases of urgent necessity. Every soldier has his own house, and a small garden, where he lives with his family, and is free to employ himself at any trade when not upon duty, or at drill. Those who are employed at the different stations upon the rivers and high-ways, have generally also a portion of land, which they have leisure to cultivate for their support, and pay their taxes from the produce, like other husbandmen. The greater part of the Tartar cavalry are stationed on the northern frontiers, and in the conquered provinces of Tartary; and the Tartar infantry are distributed in garrisons throughout the different cities of the empire. The rest of the army is dispersed among the smaller towns and villages, where they act as jailors, constables, thief-takers, subordinate collectors of taxes, guards of the public granaries, and in various other offices under the magistrates of police. A great proportion is employed at the military posts upon the high-ways, canals, &c. where they serve both as guards to prevent robberies or suppress disputes, and also as couriers, to convey the public dispatches to or from the metropolis. It is said, that few of the Chinese enter the army, except those who want ability to succeed in the civil department; and the best recruits are procured from the northern provinces.

Pay.

The pay of the infantry, including the price of their rations, according to Mr Barrow, is two taels of fine silver, about 12s 6d. per month, which may amount to 2½d. and a measure of rice, a day; but M. De Guignes makes it three taels, or 18s. 6d. per month; and that of the cavalry, according to both of these authors, is four taels, or 25s. per month. In time of war, every soldier, besides his ordinary allowance, receives six months pay advance; and a part of his regular pay is retained by government, for the support of his family during his absence.

Uniform.

The clothing of the soldier varies in the different provinces, but consists chiefly of large blue jackets edged with red, or brown edged with yellow. Some wear long pantaloons, some breeches with stockings of cotton cloth, and some quilted petticoats with sattin boots. Their heads are covered with helmets of leather, or gilt pasteboard, resembling an inverted funnel, with a long pipe, terminating in a kind of spear, at the top of which is a tuft of long scarlet-coloured hair. These caps, or helmets, have large flaps on each side, which cover the cheeks, and rest upon the shoulders, and are tied with ribbands under the chin. Sometimes these helmets are made of polished iron, and above two pounds in weight. In some provinces, the bowmen particularly wear a kind of cuirass, or coat of mail, made of brown or blue cloth, stuffed with a kind of felt, or with doublings of cloth studded with round brass knobs, each rivetted on the inside upon a small bit of leather. These are sufficient to resist the stroke of an arrow, but not a musket-ball.

Arms.

Their offensive weapons are, swords or sabres, pikes, muskets, bows and arrows. The swords, or sabres, (which they seldom wear except when on duty, and instead of which, those who act as policemen carry whips,) are worn on the left, and not on the right side, as has been supposed, with the point turned forwards in time of peace, and backwards in time of war. A corps, called Tygers of War, use long swords, and large shields of basket-work, on which are painted the faces of some monstrous looking animals, with a view to intimidate the foe. These bucklers are fully two feet in diameter, and weigh about four or five pounds.

Their match-locks, which they generally prefer to firelocks, (perhaps owing to their bad powder, and want of proper steel for making locks,) are mounted on a stock of wood, with a very small but-end; and have generally a kind of fork attached to them, upon which they rest the piece when firing. Each soldier has a black cloth pouch, painted with oil, for containing the balls, a large horn for the powder, a smaller one full of a finer sort for priming, and a small leather bag, or sack, at his arm filled with matches.

The bow is their favourite weapon, and they use it with considerable dexterity, though in a very ungraceful position. The calculate the power of the bow, by the weight which would be required to stretch it. Thus they speak of a bow of 60 or 70 pounds; and the weakest, employed in the army, are of 50 pounds, while the ordinary power is 80 pounds, or sometimes even 100. The archers wear a ring of horn on their thumb, with which they hold the string, while adjusting the bow; and the officers have this ring made of agate, which they keep in a round box attached to their girdle.

Their arrows, of which they have several rows in their quivers, are of different forms. The most singular are those, which have the iron head formed with small hooks; and those, which have it pierced with holes, by means of which they shoot letters into the ranks of the enemy, and thus carry on a correspondence with those whom they may have secured in their interest.

Their tents are made of coarse white linen, lined with blue cloth of the same stuff. They rest upon a wooden frame about 14 feet in length and 5½ in height; are fastened down all around with cords and stakes; and open at each extremity like the folds of a door. Each contains five soldiers, with two men, whose business it is to erect and pack them up. Some of them are round and covered with thick grey felt, but these, though much used by the Tartars, are too hot and dusty.

The Tartars are chiefly armed with bows and long swords; and their cavalry seldom carry more than a sabre. Their saddles are very soft, covered with cloth, and raised very high both behind and before; and their stirrups are so very short, as to make the knees of the rider almost touch his breast, which gives them a very ungraceful appearance on horseback. Their horses are small, and of a poor figure; but are tolerably active, and charge with considerable speed.

The troops are assembled for exercise and inspection at every new moon. They are said to march in a very tumultuous manner, but to perform their evolutions, and to handle their arms, with considerable dexterity. They are drawn up in lines, with the interval of a man's breadth between one soldier and another; and when those in the first line have discharged their pieces, they pass to the rear to reload, which is in like manner done by all the other lines in succession. They are distributed into companies of 25 men, each of which has a triangular standard about six feet in height; and every fifth and tenth man has a small flag, which is fixed upon a short staff at the back of his jacket. The flags and standards of the Chinese troops are generally green; but those of the Tartars are of various colours, white, yellow, red, and blue, or yellow with red fringes, white with red fringes, red with white fringes, and blue with red fringes. Every officer and soldier also, has a small stripe of silk fixed to the back of his coat, of the same colour as the flag of his company, with his name and rank written upon it.

Besides all these accoutrements, which are far from giving them a martial air, every soldier is furnished with a fan, or umbrella; and they are said to have altogether a very clumsy and effeminate appearance. The children of the emperor, and every Tartar of distinction, even to the lowest officer, are required to accustom themselves to the management of a horse, the use of the bow, and the practice of the elementary manœuvres. These Tartar cavalry display a good degree of military spirit; and, together with the troops of the northern provinces, form the bravest part of the Chinese army. The greater part, however, of the soldiery of both nations are represented as extremely deficient in the most essential military qualities, and as indebted, for their conquests over their neighbours, to their own superior numbers, and the unwarlike character of their adversaries. The Chinese troops, particularly, were so despised by the Tartars, when they took possession of the empire, that it became a common saying, "the neighing of a Tartar horse puts the whole Chinese cavalry to flight." Great honours and rewards are lavished upon the troops in time of war. An exact journal is kept of every military transaction; and those, who have displayed superior courage or skill, are particularly mentioned. Those, who signalize themselves in battle, are sure of promotion if they survive; and, if they fall, the rewards, to which they would have been entitled, are conferred upon their families and relations. Even the common soldier, who dies in defence of his country, is mentioned by name in the Gazette; and his hair, bow, and sabre, are transmitted to his family to be interred in the sepulchre of his ancestors.

Gunpowder. It has been supposed, that the Chinese were acquainted with the use of gunpowder long before the Christian æra; and it is not improbable, that this invention was known in China, before it was employed in Europe. It has been considered as highly probable, that the deflagration of nitre may have first been observed in those countries, where it is spontaneously and abundantly produced, as in the elevated desarts of Tartary and Thibet, and in the low extended plains of India and China; and it seems to be admitted as a fact, that fire arms, at least, were used by the Asiatics in war, at an earlier period than they were known by the Europeans. All this, however, is not founded upon very sufficient grounds; and there are many circumstances, which render it very questionable, whether the Chinese were acquainted with the use of gunpowder and artillery, at a period so very remote. If they have been in the habit of making gunpowder since the Christian æra, it must be allowed, at least, that their improvement in such processes is extremely slow, as that which they produce is miserably bad, and is prepared by every individual for himself. There is no public manufacture of the article, and there does not seem to be any uniform proportion observed in the different ingredients. Mr. Barrow states the usual proportion as consisting of one pound of sulphur, and one pound of charcoal, with two pounds of nitre. According to receipts received from the Chinese by the missionaries, there are three pounds of sulphur, and three pounds of charcoal added to eight pounds of nitre; and, according to another, there is only one pound of sulphur and one pound of charcoal put to five pounds of nitre. They use the nitre also in a very impure state, which makes the powder attract moisture very readily, so as to become unfit for use; and they have no mode of granulating the paste, in consequence of which the powder often cakes into a solid mass.

Fire arms. As far as their own annals bear, there is no appearance of their having made early or very frequent use of gunpowder in war. The missionaries admit, that, until the 16th century, few of the Chinese warriors understood the use of fire arms, and that Kong-ming is almost the only one, who employed them, about the year of Christ 200. It is related, however, that, when the emperor Hoay tsong had assembled his council in 1640, a mandarin proposed that the missionary, Father Adam Schaal, should be requested to provide them with cast-iron cannon; but, that another opposed the measure with this assertion, that before the dynasties of Tang (A. D. 619,) and Song (A. D. 960,) they had never heard of fire arms; and that, since that time, any attempt to use them had been attended with bad effects. In other passages of the Chinese records, where fire-arms are mentioned, there is no evidence that artillery is meant by that expression; on the contrary, it is often explained by those very historians who employ it, as implying merely burning arrows, balls of fire, and a kind of *balista* for throwing stones. It is said, indeed, that in 1232, the Moguls, in besieging Kay-fong-foo the capital of Honan, made use of cannons called Tchin-tien-looy, (i. e. thunder making the heavens to tremble) formed of a tube of hollow iron, filled with powder; but another kind of Mogul artillery is described, of which the thunder would not be very formidable, and which consisted of ribs of bamboo joined together, and strongly bound with ropes. In imitation of these, the first Chinese cannon were made of three or four bars of hammered iron joined together with hoops of the same metal; and about 100 of these guns were seen by Mr Bell of Antermony in one of the towers towards the extremity of the great wall, when he visited China in the suite of the Russian embassy in 1720. But, however early, or in whatever form, the Chinese may be supposed to have employed artillery in warlike operations, it is certain that they were never in very general use, and that they were at length entirely abandoned. The missionaries, who entered China about the end of the 16th century, agree, that they saw some bombards at Nankin, but that the Chinese could not use them. In the year 1621, when the Portuguese presented three pieces of artillery to the emperor, it was found necessary to send, at the same time, men who could load and fire them, as there was not a Chinese who knew how to manage them. After being tried at Pekin, these pieces were sent to the frontiers to be placed upon the great wall; and are said to have been found so serviceable against the Tartars, that, by the advice of the military mandarins, and the assistance of the Jesuit missionaries, Schaal and Verbiest, a considerable number were cast for the army; but, notwithstanding all the exertions of these learned men to instruct them in the art, they have made little progress, either in casting or using great guns. The only cannon, which the gentlemen of the British embassy observed in the whole of their progress, were a few ill-formed and disproportionate pieces, near one of the gates of Pekin, lying unmounted upon the ground; a few, of the same description, on the frontiers of the province of Canton; and a small number, apparently 12 pounders, at Hang-tcheoo-foo, with a wooden pent-house over each. M. De Guignes observes, that, except at the last mentioned town, none of the cannon which he saw were placed upon carriages, but upon blocks of stone; that those, on the frontiers of Canton, had the touch-hole of a very large size; and that the balls were made of dried and hardened earth. The Chinese are said to be extremely awkward and timid in the use of the few pieces, which they do possess. In making salutes, they employ three small petards, like pistol barrels, which are stuck erect in the ground, and the soldiers are so afraid in setting fire to these thunderers, that they discharge them by means of a train laid from one to the other. Yet they affect, we are told, the utmost superiority over other nations, even in this branch of the military art; and, when Captain Parish caused a few rounds to be fired, as quickly as possible, from the two field-pieces which the British embassy carried as presents to the emperor, the Chinese officers coolly observed, that their own soldiers could do it just as well, and perhaps better. When Lord Macartney, also, asked the ex-viceroy of Canton, if he would wish to see his guard perform the different European evolutions, he replied with great indifference, that such things could not be new to him, who had been so much engaged in the wars of Tartary, though there was reason to suspect, as Mr Barrow remarks, in relating the circumstance, that the gentleman had never before seen a firelock.

Fortifications.

There are a number of military fortresses, or places of arms, in different parts of the country, especially upon heights, in small islands, or at the confluence of rivers. These are furnished with cannon placed upon masses of stone, not on the top of the wall, but near to the ground, in embrasures shut up with wooden doors, on which are painted the figure of a tiger. The mandarins occasionally visit these forts, when a general salute is fired. The military places exactly resemble fortified cities; and the other forts or walls, constructed on mountains and dangerous situations, are of use only as a check upon robbers. The Chinese cities are all fortified; but their defences consist simply of ramparts, which are generally plain walls, but sometimes are flanked with square towers and surrounded with ditches. These defences are sometimes drawn in a circular, and sometimes in a square form; and are constructed of the earth thrown out of the ditch, lined with stone or bricks; but, in the latter case, there is always a few rows of stones as a foundation for the bricks. They are built in a form sloping towards the summit, but the slope is greater within than without. On the side towards the town, the bricks recede at every row; but, on the outside, the contraction is more gradual, and the bricks are placed without any apparent jutting out of the lower ranges. These walls are always higher than the houses, and are generally from 25 to 30 feet in height, and from 20 to 25 in thickness at the foundation, and from 10 to 12 at the top. The ascent is by a kind of flight of steps, or rather a gently rising road, so as that the mandarins can ride on horseback to the summit. The Chinese make little use of artillery in the defence of their towns or forts; and it has been observed that their walls could not sustain the shock, but would tumble down after a few discharges. Neither could they resist the effects of a bombardment for any length of time; and a moderately sized frigate would be sufficient to level the strongest fortresses on the river of Canton. The point, upon which the Chinese bestow the greatest attention in their fortifications, is the gate, of which there have been observed three different forms of construction, the single, the double, and the triple gate. In the single gate the entrance is strait, opening directly through the principal wall. In the double gate, the entrance is the same as in the single; but there is, in the front, a large earthen mound, surrounded by a wall in the form of a semicircle, and in which there is another opening, sometimes in a line with that in the main wall, and sometimes on one side. The space, or area, between these gates, is used for assembling the guard, and is commonly provided with a few small cannon, laid flat on masses of stone. The triple gate is very rare, and the only one observed by M. De Guignes was in Kin-tcheoo, a city of Shang-tong. In its construction and appearance, it exactly resembles the double gate; but, after passing the second opening, it is necessary to follow the direction of the exterior wall for a considerable space, before reaching the third entrance, which is placed as it were upon a line with the first. The gates have no ornamental building, but are generally formed in the wall like a continued arch or vault. Sometimes small towers are erected above them; and, in these towers, or on the outer circle of the double gates, cannon are occasionally found.

POLICE. Public Calendar.

Among the principal objects of interior administration, or general police, may be mentioned the yearly Calendar, and Pekin Gazette. The former is regarded with the utmost attention, and one is published every year at the emperor's expence. It is composed by the tribunal of mathematics, and is chiefly founded upon judicial astrology. It distinguishes the appointed days, and directs the proper mode of observing the various ceremonies and superstitions, which prevail throughout the empire, and which the government seems to find it useful to encourage.

Public Gazette.

The Gazette is printed daily, or at least every second day, in the form of a small pamphlet, and circulated through every province of China. It contains an account of all the objects of administration, and enters into the most minute details of every measure. It gives the names of the mandarins, who have been raised on account of their merit to posts of eminence; or of those who have been degraded or dismissed, on account of incapacity or misconduct. It gives lists of persons who have been convicted of capital crimes, and of those who have received pardon, &c. It details the calamities which have afflicted any of the provinces, and the relief which has been afforded by government; the various expenditure of the state in supporting troops, conducting public works, or supplying the wants of the people; the liberalities and virtues of the emperor, and the remonstrances which have been presented to him by the superior tribunals, either with regard to public measures, or his own private conduct. Nothing, however, it is to be observed, is inserted in this state paper, which does not proceed immediately from the emperor himself, or which is not submitted to his approbation. Its chief intention is to serve as an organ of government, to impress the people with an idea of the great and unceasing vigilance, which is exerted in promoting their welfare, and of the incomparable excellence of their rulers. Hence it is invested with the character of an infallible document, whose very essence is truth itself; and it is pretended by the government, that instant death would be the sure consequence of any attempt to insert a falsehood in its pages. This, however, merely signifies, that the person who has the management of its publication, would be severely punished, should he presume to insert any article that was not officially communicated from the government; for it is known to contain accounts of measures, which have never been carried into effect; of battles, which never took place; and of victories, which were never gained.

Census of the people.

One of the most ancient and peculiar internal regulations in China, is the enumeration of the people throughout the empire, by families, districts, and provinces, comprehending every individual of every rank, age, and sex. A second register is also kept, of all persons, especially of the lower classes, between 16 and 60 years of age, as the mandarins have power to call upon all who are within that period of life, either for military or civil purposes. These enumerations are made with great precision; and are remarkably useful in enabling the government to know the amount of those, who may perish by earthquakes, inundations, famines, &c.; what supplies may be required in any district, in the event of a scarcity; and what numbers can be furnished for the army.

And of the lands.

There is also a public register of all the lands in the empire, of their fertility and principal productions, both in the view of collecting the tax which the holders pay to government, and of ascertaining the state of agriculture, and the sources of manufactures in the nation.

State of roads.

The Chinese profess to pay great attention to the accommodation and security of travellers, and to the easy conveyance of merchandise; and, by means of canals, they have greatly facilitated the communication between their towns; but they have neglected the construction of good roads, where there is no inland navigation. We are informed, indeed, by some writers, of the excellence of their highways, and of the great care, which is taken to keep them in a state of proper repair. We are told of vallies filled up, and passages cut through the rocks and mountains, to preserve the roads on a proper level; of ways broad and spacious, bordered with trees, and sometimes with walls 8 or 10 feet high, to keep the travellers from encroaching upon the corn fields; of covered seats erected on all the great roads, where the passenger may find rest and shelter; of temples and pagodas by the way side, to which admittance may be always gained during the day; of large and commodious inns, though not supplied either with provisions or beds; of towers, or watch-boxes, erected at certain intervals on the great roads, guarded by soldiers, and furnished with bells and flag-staffs to convey signals. But such accommodations appear to be confined to the neighbourhood of the principal cities; or the Chinese must have different sorts of roads, as they have degrees of ceremony, some of which only they show to strangers, according to circumstances. Mr Barrow expressly assures us, that, in respect of roads, they are inferior to most civilized nations; and that, excepting near the capital, where the middle of the highway was paved to the width of 18 or 20 feet with large stones of granite, from 6 to 16 feet in length, and of proportionable breadth, and at a few places where the junction of the grand canal with navigable rivers is interrupted by mountainous ground, there is scarcely a road in the whole country that can be ranked beyond a foot-path. This assertion, indeed, is directly censured by M. De Guignes, while it is strongly confirmed, even by his own account of the matter. When he sets himself to specify the spacious and excellent roads of China, it is only, as Mr Barrow has said, of those in the neighbourhood of the larger towns, or that leading over a mountain, that he speaks. He admits, that, in the province of Quang-tong, where they chiefly travel by canals, there are only cross-paths to be seen; while he acknowledges in general, that the roads are not so well taken care of as in Europe. He acknowledges farther, that no means are used to preserve or repair those which are made; that the inhabitants are even allowed to encroach upon them with their buildings, so as to narrow the passage extremely; and that open wells are often dug in the middle of the path-way, to the great danger of those who travel during night. Nay, he says, "it is true that they are not commonly paved, and certainly this is a great inconvenience, for, in the rainy season, they are either channelled by the water or covered with clay; and, in the dry weather, they are filled with dust to such a degree, that travellers are obliged, for the protection of their eyes, to wear spectacles set in leather, which sits close to the skin." He finds great comfort, however, in this very circumstance, that in these dusty roads, the carriages rolled so very softly along; thanks heaven, that the Chinese highways were not paved; and prays, for the good of those, who may hereafter travel in that country, that the Chinese may not change their plan, till they have improved their carriages. But, in his anxiety to censure Mr Barrow, he has quite overlooked the additional comfort of these dusty paths, when, in wet and wintry weather, they will be converted into beds of mud; and even forgets the account, which he gives of his own route to Pekin in December, in which he complains of roads six or seven feet wide; of mud so deep, that the bearers of the palanquins could with difficulty get on; and of bridges without parapets, which he often passed in terror. All that the French traveller, in short, (so intelligent in other respects, but so inconsistent with himself on this point,) establishes on the subject, is merely this, that, in most places, he saw *roads marked out* and occasionally *bordered with trees*; but that, excepting in a few instances, scarcely any thing more was done to render them passable. The description given by another gentleman in the same embassy with De Guignes, of their route to Pekin, sufficiently demonstrates, either that they were intentionally conveyed through unfrequented and ruinous roads, or that the state of the highways and their accommodation for travellers is miserably bad. They were carried in bamboo chairs, and frequently obliged to halt during the night in an open uninhabited country, where not a hovel of any kind was to be seen to give them shelter; and even the lodgings, appointed for their reception at the different stages, were generally in such a ruinous condition, as to admit the wind, rain, or snow, on every side. They met with few villages or towns in their route; and many of those which they did find, were falling into total decay. The country, in many places, was covered with water, and the mud hovels melted down by the rain. They often passed over extensive wastes, where there was not a single dwelling, or trace of cultivation, in a space of 8 or 10 English miles; and it was not till they passed the Yellow river, that the marks of wheel-carriages were seen upon the roads, which were so little travelled upon, as to be traced out with difficulty. The rivers in their route had rarely any bridges, and such as were too deep to be forded, were crossed in rafts of bamboo. It is said, however, that the Chinese rulers, though sufficiently negligent in preserving their roads in good repair, are remarkably careful that their subjects shall be at least properly guided on their journey; and that an itinerary of the whole empire, comprehending every road and canal, from the city of Pekin to the most remote quarter of China, is duly published by the authority of government.

Want of inns.

There are no inns in any part of the empire, that is, inhabited houses, where the traveller may procure rest and refreshment; and this want is not compensated by the hospitality of the natives, who are rather inclined to shut their doors against strangers, than to welcome them with the offer of rest or shelter. There are, indeed, what are called inns, or rather resting-places, consisting of bare walls, where the traveller may purchase permission to pass the night, and perhaps procure a cup of tea. Of these there are a sufficient number, some of which are established by government, for the convenience of those, who travel in the service of the emperor; but the officers of the state very generally make use of the temples and convents as places of lodging, when they travel by land; and the infrequency of land-travelling in China is such as scarcely to afford support to houses of proper accommodation for passengers.

Travelling conveyances.

It is scarcely possible to procure horses upon the roads, especially in the southern provinces, but there is no difficulty in finding abundance of palanquins, carts, hand barrows, and especially excellent porters, who are chiefly employed in transporting baggage from one town or stage to another. They are united in bodies in every town under a common chief, who regulates their engagements, fixes the price of their labours, receives their hire, and is responsible for their fidelity. These offices are all regulated by government, and maintain a correspondence with each other. The traveller carries to one of them, before his departure, a list of the articles, which he wishes to have conveyed, and which is immediately entered into a book. Every thing is weighed before the eyes of the chief; the fare is generally paid in advance, at the rate of five-pence per cwt. for one day's carriage; and the traveller, on his arrival at the next city, finds every thing safely lodged at the corresponding office.

Couriers.

There are post-houses established upon the great roads, but solely for the service of government; and no one but the couriers of the state are allowed to use the horses which are found at these stations. These posts or relays are by no means very numerous, and are frequently 80, generally 50, and rarely so little as 40 lee distant from each other. The couriers carry the dispatches in a roll or long bag, covered with yellow silk, and laid across their back; and either the horse has a bell attached to its neck, or the rider strikes upon a copper drum, to announce his arrival, that a fresh horse may be ready without delay. Though the horses, which belong to government, are small, ill-fed, and carelessly treated, these couriers travel at a considerable rate, generally 100, and sometimes even 150, miles in the 24 hours; and they have been known to pass between Canton and Pekin in the space of 11 days. There are also cavalry soldiers at every city, who are intended to carry the orders and dispatches of the mandarins; but who voluntarily take charge of the letters of individuals, which they carry in a leather bag attached to their saddle.

Guard-houses.

Guard-houses, as already noticed, are also placed along the roads for the protection of travellers, at intervals of half a league, a league, two leagues, or even more; and the space between them is commonly marked upon a wooden door in their front. They are provided with a guard of five soldiers, and consist generally of a lodging-house and a stable; sometimes accompanied by a square tower about 20 or 25 feet in height, adorned with parapets, and having a small apartment on the top; or a small wooden cabin, supported by four very tall posts, to which they ascend by a ladder; or a square building of two stories, or a rising ground with a small open room on its summit. These towers, cabins, and heights are used by the soldiers as places from which they occasionally keep a look-out, and make signals to the neighbouring guard stations, by kindling a heap of straw in a brick furnace. The soldiers, however, who ought to do duty at these watch-houses, are frequently absent, and their doors shut. It is only when a mandarin is expected to pass, that they are sure to be at their post; and on such occasions the guard is drawn out, their kettle-drum sounded, and three rounds fired.

Police of the cities.

The gates of the cities are shut during night, and carefully guarded during the day, so that every one, who goes out or comes in, is observed and inspected; and if discovered to be a stranger, or suspected person, is carried before a mandarin, by whom he is detained till the will of the governor be known. There are gates also, or cross bars, at the entrance of every street, which are provided with sentinels, and which are always closed during the night. The cities are divided into districts, each of which is under its own officer; and the house-holders act in turn as constables or tything men, each of whom has ordinarily about ten houses, including his own, under his inspection; and should any riotous company assemble, or any thing contrary to good order take place in his quarter, it is his duty to give information to the nearest watch without delay. Every father of a family is a kind of inspector in his own house, and is responsible for the conduct of all under his roof. Neighbours also are considered as in some degree answerable for each other, and as bound to render mutual assistance in cases of robbery or fire. Patroles go their rounds, striking occasionally as they proceed upon a tube of bamboo, which emits a dull hollow sound; and the sentries mark the watches of the night by means of a bell or drum. Individuals also, whose property might attract robbers, generally place some of their domestics to keep watch, and to shew, by beating upon small sticks, that the whole family is not asleep. All who are found abroad at unseasonable hours are stopped and examined by the watch; and no one is permitted to pass through the streets during night without carrying a light. As the Chinese, however, frequently use in these cases torches of resinous wood instead of lanterns, and as they are extremely careless in the management of these lights, the practice is attended with the greatest danger, and often occasions destructive conflagrations, which the Chinese are as backward in extinguishing as they are negligent in preventing. In these cases the barriers of the cross streets are thrown open, and every one hastens to the spot, some to be spectators, a very few to give assistance, and the greater part to pillage those who are endeavouring to save their effects. Even the mandarins and soldiers use no means to check the progress of the flames, which are generally suffered to rage till there be nothing more to burn; and, though in the suburbs, they are happy to avail themselves on such occasions of the assistance of Europeans; yet, rather than admit them into the interior of a city, they will abandon the houses to complete destruction. Prostitutes are not permitted to reside in the interior of the cities, and have their lodgings in the suburbs, or upon the rivers, where numbers of them are associated together under a male superintendant, who is responsible for their behaviour. But it is not, as has been imagined, from a peculiar sense of decency in the Chinese, that these women are thus excluded from their streets. On the contrary, the boats in which they have their dwellings are to be seen in rows, alongside of each other, where themselves and their frequenters are openly observed by the public; while parties of pleasure are formed on the lakes and rivers by the more wealthy, in barks for that express purpose, on board of which they invite as many of these women as they choose.

Thieves.

Notwithstanding all the precautions and regulations of the police in China, pilferers and robbers are extremely numerous, and are not so readily detected as might be imagined, from the multitude of officers and institutions provided for the public security. Pickpockets abound in Canton, who are very expert in their profession, and generally make their attempts upon strangers. They go in companies along the streets, so that the article stolen is rapidly conveyed from one to another; while some of them are always ready to obstruct the way of the pursuer. They frequently lay forcible hold, even in open day, of the person whom they wish to rob, empty his pockets with wonderful dexterity, and make their escape before he can recover from his surprise. In their nightly depredations, they generally enter houses by the windows, with the aid of a light bamboo ladder, or by making a hole in the wall, in which, that they may easily find it again, they place a small candle made of saw-dust, which gives light without flame; surround the beds of the inhabitants with tables, chairs, &c. in order to obstruct their passage should they awaken and attempt to seize them; and even, it has been affirmed, burn certain drugs in the bedrooms, in order to cast the persons, who are at rest, into a deeper sleep. These bands of pick-pockets and housebreakers are said to have chiefs among them, invested with a certain degree of authority; and by entering into a composition with these persons, it is said that a stolen article may sometimes be recovered. There is not wanting also a more formidable species of banditti, who infest chiefly the sea-coasts and mountainous districts; who murder as well as plunder, and by whom not only defenceless travellers, but even whole villages, are occasionally massacred. These, however, are seldom found in the cities and more populous districts, as every robber apprehended with weapons in his hands is punished with death.

Paupers.

By the laws of China it is enacted, that all poor destitute widowers and widows, the fatherless and childless, the helpless and infirm, shall receive sufficient maintenance and protection from the magistrates of their native city or district, whenever they have neither relations nor connections, upon whom they can depend for support; and that any magistrate, refusing such maintenance and protection, shall be punished with 60 blows. Also, when any such persons are maintained and protected by government, the superintending magistrate and his subordinates, if failing to afford them the legal allowance of food and raiment, shall be punished in proportion to the amount of the deficiency, according to the law against an embezzlement of government stores. But these distributions are extremely rare and limited; and there is no country where paupers and mendicants are found in greater numbers, and in a more wretched condition, than in China. In some districts they are not indeed very frequent, because they could not find subsistence; and either perish of want, or remove to places of greater wealth. Multitudes, who may be regarded in the class of beggars, have no other habitation than a little wretched boat, in which a family of father, mother, and several children, scarcely covered with rags, and of the most meagre and famished appearance, row about the shipping at Wampoo, and procure a subsistence by the charity of the seamen, or by selling the ropes-ends, or other articles of refuse, which they pick up from the river. Numbers are destitute even of these accommodations and resources, and have been seen in the suburbs of Canton crowding together at night, to shelter each other from the cold; many of whom were occasionally found lying dead among the timber and stones upon the quay. "*La pauverté*," says M. De Guignes, who had witnessed such spectacles, "*se montre a la Chine sous des dehors extremement hideux.*" "*Les mendians, qu'on trouve dans les rues de Quanton, font horreur a voir.*" And they are so importunate, he adds, in their petitions, as sometimes to lay hold of those whom they supplicate, and seldom depart without receiving some portion of alms.

LANGUAGE AND LITERATURE.

The Chinese language is so entirely original and unique, in its whole construction, and in its constituent parts, that it may be considered as affording no inconsiderable evidence of the great antiquity of the nation. The subject, till very recently, was but little understood in Europe; and a variety of opinions, or rather conjectures, prevailed among the learned, respecting the origin, progress, and structure of this extraordinary language. From the remarks of Barrow and De Guignes, and especially from the *Dissertation on the Characters and Sounds of the Chinese Language*, by Mr Marshman, one of the Baptist missionaries in India, a more complete and consistent view may be formed of the subject, even by those who have no knowledge of the language itself, than could be collected from the varying and contradictory statements of the earlier writers upon this topic.*

Elementary characters.

The elements of the Chinese language are clearly of a symbolic or hieroglyphic nature; † and its written signs may be described as imitations of natural objects, combined in a variety of forms, in order to convey, or rather to exhibit, ideas to others. The formation of the written characters is extremely simple; and their constituent elements, though variously enumerated in different dictionaries, are, at most, 214 in number. These are called by the Chinese Tsi-moo, or mother characters, and sometimes Poo, or ruling characters; but by the European missionaries they are designated claves, or keys: and by the various combinations of these elementary figures, all the other characters in the language are formed.

Origin of these elements.

The origin of these mother characters is entirely a matter of conjecture; but they may be conceived, as seems to be the general opinion, to have taken their rise from the first rude attempts of men to delineate objects of sight, as a mode of expressing their ideas to others. These representations, or outlines, may be supposed to have been at first very imperfect picturings, and to have lost, by degrees, much of the little resemblance, which they ever possessed to sensible objects. All the Chinese literati consider this to have been the nature of the first endeavours to form a written character; but they are fond of representing the lines of Fo-shee, broken and unbroken, disposed in circles, squares, and polygons, as at once the most ancient of their records, and as a specimen of the original language of their country. They pretend, however, to trace the use of the present characters as far back as the reign of Hoang-tee, about 2700 years before Christ; a period at which, according to their own histories, their nation, if at all in existence, must have been in a very rude and uncivilized state. But whatever may have been the date of the origin of these characters, it appears from inscriptions upon antique seals of agate, vases of porcelain, and cups of serpentine stone, as well as from successive editions of their oldest books, that they bore a considerable resemblance to the objects, which they were intended to represent.

Objects of these symbols.

The individual figures at first selected to form the basis of this mode of communication, include the most remarkable objects of nature, as the sun and moon, a river, a mountain, fire, water, earth, wood, stone, &c.; the principal parts of a house; the utensils most commonly in use, such as a knife, a spoon, a seat, a box, a staff, &c.; the chief articles of subsistence, grain, pulse, flesh, fish, &c.; the primary relations of life, father, mother, son, daughter; some of the most obvious qualities of bodies, such as straightness, crookedness, greatness, smallness, height, &c.; a few of the most common actions of life, such as seeing, speaking, walking, running, &c.

These original elements, of which the other characters, or rather words, are composed, may be regarded as, strictly speaking, the alphabet of the Chinese language.

Prevailing symbols.

They are, however, very irregularly and unequally brought into use in the composition of characters; and, while some of them enter, as roots or primitives, into the formation of 1400 or 1500 characters, others have only two or three descendants. *Mook*, wood, for instance, enters into the composition of 1232 characters; *soi*, water, into 1333; *tchou*, grass, or vegetation in general, into 1423; *shoo*, the hand, into 1012; *kou*, the mouth, into 983; *sin*, the heart, into 956; *nee*, a woman, into 834; *yun*, a man, into 729; *wy*, denoting reptiles, into 804; *gniu*, a word, into 734; *kyam*, or *kyun*, gold, into 719; *see*, silk, or any thing fine and delicate, and *tchok*, a bamboo, into 672 each; *yok*, flesh, *san*, a mountain, *mook*, the eye, *tchok*, the foot, *nieu*, a bud, into somewhat more than 500 each; *ma*, a horse, *khin*, a dog, *yul*, a day, *tou*, a knife, *tchee*, a place, *mic*, me, *tcheek*, motion, into somewhat more than 300 each; and the elements, which represent earth, stone, disease, clothing, and jewels, have above 400 in their respective classes. Thus do thirty of the elementary symbols, expressive of the primary objects of sense, enter into the composition of nearly 20,000 characters; which are supposed to constitute more than one half of the characters in the language. Some of these elements, on the other hand, enter into so few characters, that they are scarcely entitled to be ranked among the primitive figures. The six elementary symbols, which compose the class formed by one stroke, and which are all obsolete, except *yut*, one, include altogether only 95 characters, and one of them has only two derivatives or compounds. Among those which consist of many strokes, there are 40, which comprise in their respective classes not more than 20 characters each, some of these having only 10, and the whole 40 making only 615. Twenty others contain only from 20 to 35 each, and altogether only 557. So that here are 84 of the elements which enter into the composition of only 1427 characters, which is little more than the number classed under the single element of *tchou*, vegetation.

Thus the effective elements amount only to 130, while the rest of the 214 very rarely occur in writing. The whole useful and practical part of the language, also, instead of amounting to 80,000, according to the French missionaries, contains only about 35,000 characters; many of which even are synonimes, and one third of which is more than sufficient for the common purposes of life, and for understanding most of their books. Thus the whole text of the Ta-tsing-leu-lee, or present code of Chinese laws, consisting of 100,000 characters or words, does not contain more than 1860 that are essentially different from each other. The dictionary Shue-ven, composed by Hui-tchee, under Ho-tee, of the Han dynasty, A. D. 89, and the other dictionaries composed after him, contain only between 8000 and 10,000. Additional characters were formed at different periods, and in consequence of changes in the state and relations of the empire; especially when the Chinese became united with the people of the East; when the Bonzes of Fo arrived in the country, a short time after whose establishment, the characters were numbered at 26,430; and when the Tao-tse, imitating the innovations of the rival sect, made new inventions; so that in A. D. 1090, the dictionary presented by Se-ma-kouang to Gin-tsong, contained about 53,165 characters, of which, however, 21,846 are double, to express a different meaning. As the formation of characters, too, by the combination of the 214 elements, is not left to the fancy and pleasure of individuals, but as the sanction of government is requisite to authorise the introduction of a new character into common use; this essential part of the language is completely uniform and stable. Changes may have taken place in the form of the characters, by the removal of redundancies, or the rounding of angles, especially in writing; but the principles upon which they are constructed, continue fixed and invariable; and it is asserted by those who are well acquainted with the subject, that the Chinese language has not borrowed a character or syllable from any existing tongue, or undergone any material alteration in its sound or form, for more than 2000 years. Every new article imported into China, receives an appellation in the language of the country, and soon loses its original name. Even the proper names of foreign countries, nations, and individuals, are translated, or at least converted into others, of a Chinese formation. Thus, Europe is called *See-yang*, the western country, and Japan, *Tang-yang*, the eastern country; Englishmen, *Hung-mou*, red heads, &c.

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* The latest publication on the subject, of which we have heard, is a Grammar of the Chinese language, published by Mr Morison, a Christian missionary at Canton, and dedicated to Lord Minto, the present governor of Bengal, who, like his predecessor Lord Wellesley, has extended his encouraging patronage to the cultivation of Oriental literature; and whose liberal and enlightened mind is not restrained by the influence of prejudice or party, in estimating the merit of those, who have distinguished themselves in this department.

† This point is well established and illustrated in a treatise by one of the Jesuit missionaries, published at Brussels in 1773, and entitled, *Lettre de Pekin sur le genie de la langue Chinoise, et la nature de leur ecriture symbolique.*

Modes of writing.

With respect, however, to the form of writing the character, the above assertion must be taken with considerable deductions. Previous to that period, which, even by the accounts of the Chinese, is scarcely so remote as 2000 years, various changes were made in the form of writing. 1. The first is called Kho-theoo, which they regard as the most ancient form of writing, and the invention of which they ascribe to Tsang-hie, whom some consider as the same person with Sse-hoang, a prince prior even to Fo-hee, and others as a mandarin under Hoang-tee. He is said to have taken the idea from observing the footsteps of birds upon the sand, and therefore called the characters which he invented Niao-ky-tchouen (*letters imitating the footsteps of birds*); but, as they were supposed to have a resemblance to an animal called Kho-theoo, a kind of water insect, they received and have hitherto borne this last appellation. These are understood to have been the characters in use under the three first dynasties, and not to have exceeded 540 in number. 2. The second, called Ta-tchouen-tse, appeared in the reign of Siuen-vang, about 826 years before Christ, when Shee-tcheoo, president of the historians, arranged the characters under 15 classes, and the emperor caused them to be inscribed upon ten drums, nine of which are said to be still preserved in the imperial college at Pekin. 3. The third, called Siao-tchouen-tse, were new characters composed by Ly-se, the prime minister of Shee-hoang-tee, about 246 before Christ, and founded upon the ancient 540 characters; but the form of these being afterwards changed from crooked to straight lines by Tching-miao, who had assisted Ly-se in composing them, they were called Ly-tse; and new corrections having been made upon the system under Eul-shee-hoang-tee, 206 years before Christ, they were named Kiaee-tchoo. 4. The fourth, called Tsao-tse (*characters of herbs*), were invented under Tchang-hoang-tee, A. D. 80, but as this mode greatly disfigured the characters, it was soon abandoned, and is now used only as a running hand. 5. The fifth and present character, called Hing-shoo, was invented under the Heoo-han, or posterior Han, who reigned from the year of Christ 224 to 264, by a person named Lieoo-te, who, while he preserved the spirit and system of the ancient characters, endeavoured to facilitate the manner of writing them. But he thus deprived them of their resemblance as pictures to the objects which they expressed; and hence these modern characters do not speak so well to the eye, as those formerly in use. Though capable of being more expeditiously written, they require more care in the formation, as a single stroke, more or less, would often alter the signification entirely, while the ancient characters, being a kind of pictures, were in a great measure intelligible, whether well or ill drawn. The Chinese have still various modes of writing the characters, as it is certain that, when the emperor Kien-long ordered his poem of *Mouk-dan* (the name of the capital of Mantchoo, Tartary,) to be written out in all the various kinds of character which had at any time been in use, it was found, that they amounted to the number of thirty-two. The dictionary published by order of the emperor Kang-shee, has now indeed fixed the form of the written character more decidedly; as it is accounted a breach both of good taste and sound loyalty to alter or abbreviate the characters employed in that publication.

Combination of elements.

The knowledge of the elementary characters does not lead, as might be supposed, to a knowledge of the meaning of their combinations; as there frequently exists no affinity whatever between the signification of the compound and its component parts, or at least such a connection only, as is founded more in fancy than in fact, and as could never be discovered by the learner, in consequence of his previous attainments. The constituent parts, indeed, of every compound character, are always distinctly separated, and accurately described in the dictionaries; but it is very seldom, that an explanation of the meaning can be drawn from the import of these elementary materials. The number of the primitive signs is too limited to express a great variety of ideas; and among those which are invented, there is a great want of those leading and general representations, under which a systematic classification of mixed objects and abstract notions might be arranged. Hence, though the plan of the written language may appear well adapted to be the groundwork of a philosophical character, as a universal medium of communication; the theory has been greatly marred by the Chinese in the execution, and their whole language seems to have been formed rather by accident and caprice, than by system and design.

Classification of characters.

The whole characters of the Chinese language are usually arranged, in their own books, under the six following classes, to which they give the name of Lo-tchoo.[*]

1. Siang-hing, i. e. *image and symbol*, or those which give the simple figure of the object, and sign of the idea, comprehending two kinds of characters, first, those which represent, by a visible picture, the objects expressed, as the figure of a vase employed as the character or word for a vase; secondly, those which are either by allegorical signification or arbitrary appointment the signs of intellectual ideas, as the figure of a heart to express love and affection. This class comprehends the elementary symbols.

2. Tchee-sse, i. e. *indication of the object* or idea, or those compound characters which follow the simple and obvious sense of the primitives of which they are composed, and thus give at least some indication of the meaning. Thus the character of *little* combined with

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[*] The term Lieou-lee, or Lieou-ee, by which some of the missionaries have distinguished these classes, is used by the Chinese to denote rather the six primitive arts of life.

that of *strength*, denotes weakness; the character of *man* written three times signifies a *multitude*; or if they are placed in a line behind each other, it denotes the action of *following*; and the character of *herbs* and *water*, united with that of a *field*, expresses a swamp or marshy soil.

3. Hoey-ye, i. e. *combination of the object* or idea, includes those characters, which convey a sense, bearing no immediate relation to the separate significations of the signs of which they are composed, but which may be found to possess a kind of distant analogy with the ideas expressed. Thus the characters of *mouth* and *dog*, signifying to *bark*; those of a *door* and *mouth*, to *ask a question*; those of a *door* and *ear*, to *hear*; those of a *foot* and *lose*, to *fall*; those of *man* within an *inclosure*, a *prisoner*.

4. Kiai-in, i. e. *explanation by the sound*, includes those characters, which are composed of the character of a genus with another character, which, by its sound or some other peculiarity, or by mere arbitrary appointment, designates a species of that genus; and which thus constitute a classification of objects in natural history, articles of household furniture, &c. Thus the character of fish with another sounding *lee*, denotes a *carp*; that of *bird* with another sounding *go*, signifies a *goose*; that of a *tree* with another sounding *pe*, signifies a *cypress*; or with one sounding *lioo*, signifies a *willow*.

5. Kia-tsié, i. e. *idea borrowed or metaphorical*, includes those characters, which, besides the simple signification of the character itself, have also another meaning of a figurative nature. Thus the character of a *tower* signifies literally a building of that name, and also *immobility*; that of *sun* and *moon* united denotes literally *brilliancy* or *splendor* in a physical sense, and also *noble* or *illustrious* in a moral import; *speech* and a *mountain* denote *boasting*; the *wife of a magistrate* implies farther an *accomplished* lady; a *wild boar* both signifies the animal so called, and also figuratively *courage*. This class is exceedingly numerous, and may indeed be said to comprehend the whole characters of the language, which are all occasionally used in a figurative sense. This application of simple characters in a metaphorical import, is the great source of the obscurity which necessarily pervades Chinese compositions, as the figurative meaning frequently bears no conceivable analogy to the primitive sense, or at least one extremely remote.

6. Tchuan-tchoo, i. e. *extension, developement*, includes those characters, in which the obvious or figurative signification is varied either partially or wholly by another character placed above or below, on the right or the left; but, whether any regular principle is observed in this alteration or extension of the meaning by *juxta position*, does not appear. Thus the character of *mountain* alone signifies a *single mountain*; two of them in a line, *a range of mountains*; and these two surrounded by a third, an *elevated mountain*; a *heart* placed above a *slave* signifies *anger*; an *ear* at the side of a *heart* denotes *modesty* or *shame*; a *man walking* and a *word*, *vain promises*.

Analysis of characters.

To trace the meaning and composition of the different characters is described as a very entertaining analysis and ingenious exercise; as affording also the most curious examples of the operations of the mind in different nations and ages, in combining and associating ideas. The greater part indeed cannot be traced to the circumstances and notions which gave them birth; but it is most probable, that, in many instances, this difficulty arises from a want of acquaintance with the history, customs, manners, sentiments, and traditions of the Chinese nation, to which it is evident that numbers of these combinations have a direct reference. Thus the Emperor Yao and a word signifies *religious discourse*; the same person with the sun denotes *eminent knowledge*; and with provisions, conveys the idea of *nourishing the people*; all these significations evidently alluding to the character ascribed in history to that prince. A bow and the chace express *the nations of the north*; a man and a flock, *those of the west*. Wine and a seal express *marriage*, because it was the custom for the bridegroom to present wine to the bride, which was thus the seal of their union. A garment and a halbert signify a *short coat*, because soldiers usually wore short clothes; old and word *instructive conversation*, because wisdom is supposed, especially in China, to be the character of the aged. Woman and sickness express *death*, because when the sovereign was sick and given up by the physicians, he was left in the hands of the women. A concubine, or second wife, is signified by *girl* and *upright*, because she must stand up, and is not allowed to sit in the presence of her husband. The *intercalary moon*, or month which returns at certain intervals to make the lunar agree with the solar year, is represented by the character *king* in the middle of a *door* or gateway; because it was anciently the custom, at the return of the intercalary month, for the sovereign to stand in the gate of the temple when making his oblations, instead of performing the ceremonies, as on other occasions, within the temple. To govern is compounded of *bamboo* and a *clapping noise*, which sufficiently indicate the great instrument of Chinese administration, the stroke of the bamboo; and the character signifying foreigner is composed of *great* and *bow*, perhaps because the first strangers, who entered the country, carried longer bows than those of the natives.

Sound or pronunciation of the characters.

The Chinese characters are not addressed solely to the eye, but are all capable of being named so as to be in some measure intelligible by the ear. But it cannot be said, properly speaking, that each character has a distinct name or sound. These sounds are very few in number, between 300 and 400 only; and, hence, many characters, essentially distinct in their appearance, have the same name. Even these names, also, are not composed of the names of the component parts of the character; but, however numerous these may be, its own name is always a monosyllable, which generally bears no resemblance to the sounds of its constituents. Thus the character expressing happiness, is composed of four characters, viz. *shee* a dæmon, *ye* one, *koo* a mouth, and *tien* a piece of cultivated ground; but the word or character *happiness* itself, has the simple monosyllabic name or sound of *foo*. Hence it is, that the written Chinese characters, like the notes which compose a piece of music, may be intelligible to different nations, whose spoken language is different, that is, who give different names to the visible words or characters. This is actually the case in Japan, Tonquin, and Cochin-china, where different languages are spoken, but where the same written character, namely that of the Chinese, is used. Indeed it is said that such is the case, even in the empire of China; and that scarcely any two of its provinces pronounce the characters in the same way, or, in other words, have the same oral language.

Chinese alphabet, or marks of sound.

For the purpose of regulating the pronunciation, or names of the characters, the Chinese have a class of characters set apart as marks of sound, which may be called their alphabet; but when, or by whom, these were invented, is not known. This alphabet has a close connection with their imitative character, and is considered as extremely simple and effective. It consists of 36 characters, whose names furnish so many initial consonant sounds; and of twelve other selected characters, whose names furnish as many final sounds. Some of the initial consonants, however, are so much alike, that scarcely more than 24 of them can be considered as admitting of a separate pronunciation. They are distributed into nine classes; and their power is expressed in the following Table, as far as it can be effected by English letters.

1	K.	Kh.	K.	Gn.
2	T.	Th.	T.	Ng.
3	Ch.	Chh.	Ch.	n.
4	P.	Ph.	P.	m.
5	F.	Fh.	F.	m.
6	Ts.	Tsh.	Ts.	S. S.
7	Tch.	Tchh.	Tch.	Sh. Sh.
8	Y.	H.	Y.	Hh.
9	L.	Y.		

This alphabet, according to the conjecture of Mr Marshman, may be conceived to have been formed in the following manner. Suppose the two characters of sun and moon, named *je* and *yue*, united into one to express brilliancy; and this new compound to have been at random named *ming*, a sound without any meaning or reference to the sounds of the component characters. In order to express this sound to another person in writing, as the conventional term for this character, it might be natural to look among the characters already named, especially the elementary symbols, for one or more, whose sounds approached nearest to that of *ming*. Among these the character *moo*, wood, would be found to have the same incipient sound as *ming;* and the character *ching*, blue, the same final sound. Thus might these two characters placed together, convey to another person in writing, an idea of the word *ming*, by uniting the initial of the one with the final sound of the other; and then they might continue to form part of the new alphabet, the one always indicating the sound of m initial, and the other that of *ing* final. The twelve vowel sounds with two nasal in addition, are a, e, i, o, ou, u, an, ang, en, eng, in, ing, oun, oung; and in the Imperial Dictionary, the whole alphabet is explained by twelve tables. The characters, representing initial sounds, are ranged along the head of the page, while those which denote the final sounds, form a column along the margin; and, at the angle, formed by lines drawn from the characters in these two columns, is placed a well known character, which expresses the sound produced by the union of the two, the initial and final sounds. This may be better understood from the following example:

Initial Sounds.

Final Sounds.	P-ong	Ph-ong	M-ing	Ts-ing
K-an	Pan	Phan	Man	Tsan
K-ou	Pou	Phou	Mou	Tsou

Here it is evident, that the initial sound of P-ong united to the final of K-an produces Pan; that the initial of Ph-ong, with the same final of K-an, makes Phan; that the same initials of P-ong and Ph-ong, with the final of K-ou, make Pou and Phou, &c.

Number of syllabic sounds.

In this manner, by the combination of the 36 initial consonants, and the 12 final sounds, are produced and represented 432 simple monosyllabic sounds, which, in fact, form the amount of syllables in the oral language of China. But, as these few syllabic sounds would occasion great ambiguity when distributed among 35,000 different characters, the sounds of the final syllables have been so variously modified, as to increase the original number of syllabic sounds to 846; and these again, by means of certain accents and intonations of the voice, are augmented to 2178.

Accents.

These accents bear some resemblance to those of the Greeks, and are chiefly, four; *Ping*, which signifies *even* and *moderate*, is the common or grave accent; *Siang*, which signifies *ascending*, is the acute accent; *Shee*, which signifies *protracted*, is the long sound or syllable; and *Yu*, which signifies to *stop short*, is the short sound or syllable. In order to mark these accents in writing, the Chinese assign to each of them a particular angle in those characters, which change their meaning according to their accents; the inferior left angle to the accent *ping*; the superior left angle to the accent *siang*; the inferior right angle to the accent *shee*; the superior right angle to the accent *Yu*; and these angles are marked in the school books with an O, frequently of a red colour, to point them out more readily to the notice of the learner. Still, with all the aid which can be derived from these accents and flexions of the voice, the spoken language is full of ambiguities, which, though frequently removed by the general meaning of the discourse, are sometimes perplexing even to the natives. Thus, by dividing 35,000 characters by 2178 syllabic sounds, the number of characters or words, which have precisely the same sound or pronunciation, will be 16 in each class of sounds; and, by dividing by 846, the number of those which have nearly the same sound, will be 41 in each class. In the case of these words, which have the same sound, a second syllable is sometimes added to make the distinction more clear. Thus the syllable *foo*, a name given to several characters of different meanings, denotes a father; and when used in this sense, the word *chin*, kindred, is generally added, as *foo chin*, father. Nothing also is more common, than for the hearer to interrupt the person who speaks, in order to ask an explanation of any ambiguous expression; and this explanation he endeavours to give by adding some synonymous or analogous term. But, with all these resources, a Chinese is frequently unable to make himself understood by his speech; and to explain his meaning, describes in the air with his finger or fan, the figure of the character, whose sound he wishes to utter. All this ambiguity is greatly increased by the obscure manner, in which the Chinese designedly express themselves; affecting to say much in a few words, and omitting, for the sake of elegance, the explanatory phrases.

Dictionaries.

The Chinese dictionaries are arranged, either according to claves, or accents. The dictionaries of the former description have the 214 claves, or elementary symbols, (though sometimes a greater number is used) drawn in a fair and distinct form, along the top of the page, commencing with the more simple, which contain the smallest number of lines or points, and proceeding to the more complicated, in which may be found, at the utmost, seventeen lines. On the margin of the page, are marked the numerals 1, 2, 3, &c. which signify, that the root or element at the top will be found in that page combined with one, two, three, &c. lines, or points. The first step, in examining a dictionary for a particular character, is to find its key or root, which is placed on the right, on the left, at the top, or at the bottom, and which a little practice soon enables the learner to distinguish. The meaning of the character may then, sometimes, be conjectured from the root or key; as the sign of the *hand*, found to be the key of any character, would imply, that it expressed some work of art, trade, or manufacture; or that of the *heart*, some of the passions, affections, or sentiments of the mind. When it is necessary to proceed farther, to ascertain the precise meaning from the dictionary, the next step is to count the number of lines or points in the character, without including those of the key or root; and this is considered as one of the most perplexing exercises to the beginner, as he is apt to reckon those lines, which are merely terminations, or joinings of the different strokes, and which he can learn to distinguish, only by being accustomed to write, as well as to understand the characters. Suppose then the character, for which the dictionary is consulted, to have, as its key, the simple sign expressing *water*, and to contain, besides, six additional lines or points, the scholar turns to the place, where the character water stands, at the top of the page, and looks along the margin, till he find the numerical character six, when he will perceive all the characters in succession, which are formed of the sign of water, with six additional lines. Besides the signification of the character, its name or sound is, at the same time, expressed by the alphabetical signs, already described; as, for instance, to shew the pronunciation of the character *tchong* faithful, there would be found underneath it the words *tchee*, and *loong*, with the term *tsie* to cut or divide, denoting, that the initial *tch* and the final *oong* are to be divided or separated from their respective words, and joined together, to form the sound required, *tchoong*. There are dictionaries also among the Chinese, arranged according to the accents, by which, if the pronunciation of the character is known, the signification may be found; and others, in which the characters are distributed, as in a vocabulary, under different heads, where, if their meaning is known, their name and pronunciation will be found.

Grammar.

In the Chinese spoken language, there is no *b*, *d*, *r*, *x*, or *z*; no word begins with *a* or *e*; and all of them terminate with the vowels, *a*, *e*, *i*, *o*, *u*, *ou*, or the consonants *n*, *ng*, and *l*. The grammatical construction of the language is extremely simple. There is no inflexion of termination; but every character remains the same unchangeable monosyllable, through all its numbers, persons, moods, or tenses; and may be employed as a noun, adjective, or verb, without the smallest variation in its sound or form. The signification is thus determined by expletives or particles, which are frequently omitted in the written language, especially in the more elevated compositions; but which are more numerous in the spoken language, and colloquial style.

Substantives.

In *substantives*, the genitive case is formed by the particles *te*, *tie*, *tche*, placed after the nominative; or, when these are suppressed, by putting the word in regimine before the other, as *kia-tchoo* of the house the master; the dative, by the particles *eu* or *ee* preceding the word; the accusative by its position, which is almost uniformly after the verb; the ablative, by the particles *tung* or *tsung* before the noun; and the plural number is produced by the addition of the syllable *men*, or *mun*, or by some word expressive of quantity or plurality, as *to-jin* many men, or by repeating the noun, as *jin, jin*, men.

Adjectives.

In adjectives, there is no termination to express agreement with the substantive in gender or number; but they are generally placed before the noun. Many adjectives are formed from the genitive of the substantive, as *pai* whiteness, *pai-tie* white, *hau* goodness, *hau-tie* good; but, when united with a noun, the particle is generally omitted, as *hau jin*, a good man. The comparative degree is formed by prefixing the particle *keng keng hau*, better; and the superlative, by repeating the word as *hau-hau* very good, or by adding farther the particle *tie*, as *hau hau-tie*.

Pronouns.

The personal pronouns are *go*, or *ngo*, I; *ne*, thou; *ta*, he; of which the plurals are *ngo-mun*, we; *ne-mun*, you; *ta mun*, they. The sign of the genitive converts these into possessives; as *ngo-tie*, mine; *ne tie*, thine; *ta-tie*, his; *ngo-mun-tie*, ours; *ne-mun-tie*, yours; *ta-mun-tie*, theirs.

Genders.

The genders are sometimes expressed by particles prefixed, as *nan-jin*, a man, *niu-jin*, a woman; but different words are employed in the case of animals, as *kong* a male, and *moo* a female quadruped; *Hiong* or *kio*, a male, and *moo* or *tse* a female bird.

Verbs.

In verbs, there are only three tenses, that can be said to be distinctly marked, the present, the past, and the future, as *ngo-lai*, I come, *ngo-lai-leao*, I come or have come, *ngo-shau-lai*, or *ngo-pee-lai*, I shall or will come, or, when any determined future purpose is expressed, *ngo-yuen-ee-lai*, I am determined to come. The other moods and tenses are marked by particles, adverbs, or even by other verbs; as in the imperative, or at least what corresponds with that mood, it is often said, *Kaee khee*, to open begin. In like manner, a passive signification is expressed by certain particles, such as *shee*, equivalent to is or are, *pee* to was or were, &c.

Syntax.

The syntax is also simple and easy; the nominative generally preceding, and the accusative following the verb. The chief difficulty consists in properly placing the prepositions, adverbs, conjunctions, and other particles, upon the exact position of which the meaning and elegance of the expression often entirely depend. The two negatives *mo* and *poo* are particularly frequent in the spoken language, and have a very extensive use. The first, generally employed along with the verb *yeu*, expresses want, or deficiency, as *mo-yeu-nai*, there is no milk, I have no milk; the latter denotes an opposite quality to the word, which it accompanies, as *hau*, good, *poo-hau*, bad; *je*, hot, *poo je*, cold.

Mode of teaching.

The mode of teaching the written language, as practised among the Chinese, appears to be exceedingly tedious and preposterous. Instead of teaching first the signification of the simple roots, and the analysis of the compound characters; and afterwards, or, at the same time, the sounds or pronunciation; the scholar continues, for five or six years, to learn to name the several characters, without attending to their meaning. He is next employed, for at least four years more, in learning to form the characters, by tracing copies faintly drawn with red ink, and then, by imitating them on fresh paper; in combining the pronunciation with the writing, by naming the lines and points which compose a character, and describing the form and order, in which these lines must be placed, in drawing the character; and in acquiring the difficult talent of following the motions of a person's finger, describing the different characters in the air. Thus a youth, of fourteen or sixteen years of age, is able to write and name a multitude of characters, without knowing the meaning of one. The last step is to analyse the characters by the help of a dictionary, and to understand the use and signification of the written language. In this way, the scholar passes through a regular course of reading and hard study.

Elementary books.

The elementary books are; 1. The Pe-kia-sing, or *proper names of a hundred families*, a book, which contains the various names of individuals in the nation, which are all significant words, and require to be known when found in books, that they may not be mistaken for the names of things; 2. The Tsa-tse or *collection of letters*, a book, which treats of common things, and the necessary articles of life; 3. The Tsien-tse-ooen, or *collection of a thousand letters*, a book which contains 1000 different words, arranged as short phrases of three or four characters; and, 4. The San-tsee-king, or *verses of three syllables*, a book, in which every member of a sentence contains three characters, and which teaches the simplest moral reflections and historical events. They next pass to the Ssee-shoo, or *four books*, containing the moral precepts of Confucius, which they commit to memory, and learn to write out without looking at the book. They are then introduced to the perusal of the *king*, or classical books, of which an account will afterwards be given; and after being exercised in the elevated style of composition, by which time they are generally about twenty years of age, they are to enter upon the first examinations.

Examinations.

These take place in the presence of the governor of a city of the third order, and are generally attended by about 600 students, of which perhaps about 400, who receive the name of Hien-ming, pass to the second examination, before the governor of a city of the first order, when they are employed in producing a piece of literary composition, and in which case, seldom more than 200 are chosen to receive the title of Foo-ming. Before, however, they can be admitted to the higher offices, they must continue to study, and to undergo examinations, for the space of about ten years more. Every three years, a mandarin from Pekin holds two examinations in the chief city of every province; and the Foo-ming, appear before him without books, to prepare their compositions. Of these he is supposed to judge impartially, without knowing the authors, (though money and influence generally prevail) and a small number of the most eminent, perhaps fifteen out of some hundreds of competitors, receive the title of Sieoo-tsai, or bachelors. All, who are admitted into this class, wear a distinguishing badge, and can be punished with the bamboo, only at the judgment of a particular mandarin, to whom the inspection of their conduct belongs. But, as they must continue to produce compositions at the examinations, in order to preserve this degree; the greater number of candidates purchase, at the rate of £100 sterling, the title of Kien-song, which, though attended with less honour, is also attended with less labour, than that of Sieoo-tsai. Both these classes, repair every three years, to the capital of their province, where they compete, by their compositions, for the title of Kiu-jin; and, the following year, all the Kiu-jin, from the different provinces, are required to attend an examination at Pekin, which takes place every three years, and at which the most advanced receive the title of Tsin-tse, or doctors. Those who attain this rank in learning, are eligible to the most important offices in the empire; but the greater part of the literati remain satisfied with the title of Kiu-jin, which is sufficient to obtain for them very honourable stations. This course of study is not pursued in China so much from a love of learning as of place; and a learned man, without wealth or office, is not held in great estimation. These degrees also are frequently purchased; the sons of the higher mandarins are admitted to offices of eminence, without any examinations or degrees; and it is not uncommon to find the governor of a city a mere military mandarin, without any literary acquirements, and assisted in his duties by inferior civil officers. These examinations are restricted merely to a knowledge of the language. Each candidate is provided with pencils, ink, and paper, in a separate apartment, and produces a theme upon a given subject in a given time. The excellence of the composition consists in these points, that the characters be neatly and accurately made; that they be well chosen, and not those which are in vulgar use; and that none of them occur twice in the same composition.

Styles of composition.

There is a variety of styles, or modes of composition, in the Chinese language:

1. The Koo-ooen, or the style of the books named *King;* and which is subdivided into three kinds, one extremely concise and full of metaphors, which is the style of the *King;* a second is that of the books composed after the *King*, till the destruction of the Chinese books by Shee-hoang-tee, 213 years before Christ; and a third is the style of the books, produced from the dynasty of the Han until that of the Song. The two last bear a great resemblance to the first, and can be distinguished only, as connoisseurs distinguish an original painting, of some celebrated master from a copy, taken by a skilful hand.

2. The Ooen-tchang, or the style of elevated compositions, which is not so laconic as the Koo-ooen, but is even still more flowery and recondite. In this style, a writer is expected to choose such characters, as at once give ornament, meaning, and vigour to his sentiment. In speaking, for instance, of the death of the emperor, instead of using the ordinary word Sse, *to die*, he would employ the term Pin-tien, *a guest has entered into heaven;* or, what would be still more emphatic and sublime, the word Pong, *a mountain is burst and tumbled in pieces.* Neither must the same sound frequently recur in the perusal of the piece; a circumstance, which, owing to the small number of sounds in the language, it is most difficult to avoid. To compose, in short, in this style, requires the greatest care and knowledge; and is a very rare attainment.

3. The Kooan-hoa, which is the style employed by the mandarins, the literati, and all well educated persons, is much more extended than the last mentioned; admits of synonymes, and all those connecting particles which give clearness to the discourse; and allows the words to be arranged in a more simple and natural order; but cannot be employed so well in writing, and serves only for oral communications.

4. The Hiang-tan, which is only a corruption of the former, is the ordinary dialect of the populace, and varies in the different provinces and districts. Persons of education are able to speak in the common style of their native place, but never employ it in conversation with mandarins or learned men.

Punctuation.

The Chinese make no use of punctuation to distinguish the conclusion of their sentences; a circumstance which greatly increases the obscurity of their compositions, especially in the elevated style. Sometimes in their commentaries, and especially in the Chinese books published by the missionaries,* the mark O is introduced to point out the termination of a sentence. The Chinese authors follow as closely as possible the style and manner of their ancient writers; and as these never

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* These publications are considered as the best adapted for learners of the language; especially a small theological treatise, entitled, Ooan, ooe, tchin, iooen, or, *the true origin of all things.*

Language.

employed any kind of punctuation, it would discredit a modern author, and almost infallibly expose his pieces to condemnation, were they disfigured by the useful but vulgar invention of points.

Stability of the language.

In consequence of this faithful adherence to the ancients, the language has undergone no radical change, since the days of Confucius, whose style and manner differ very little from those of the best modern Chinese productions, except that these latter are seldom so concise; and there is still extant a dictionary, entitled See-ooen, compiled under the dynasty of Han, about 2000 years old, which is still considered as of high authority. The Chinese seem to cherish a kind of sacred reverence for their written character; and it is accounted not merely a want of taste, but even a positive misdemeanour, to tear a written paper, and throw away the fragments. Every scrap of writing is carefully picked up, and put into a small pouch, or hollow bamboo, which every man of letters carries about with him for the purpose. The circumstance of a language, spoken by so large a portion of the human race, continuing during such a length of time without any material change, has been considered as a striking confirmation of the observation of Dr Johnson, in the preface to his Dictionary, that "the language most likely to continue long without alteration, would be that of a nation raised a little, and but a little, above barbarity, secluded from strangers, and totally employed in procuring the conveniences of life."

Literature.

There is still very little known in Europe of the state of literature in China, and of the contents of their various writings. Their books are distributed into four classes; 1. The sacred, or canonical books, which comprehend every thing relating to the study of the language; 2. The writings of the historians; 3. Those of the philosophers; and, 4. The miscellanies, or poetry, eloquence, &c. Of these, the most esteemed, and the most studied, but at the same time the least understood, are the few books, or rather fragments, which are supposed to have escaped the conflagration of Shee-hoang-tee, and which are distinguished by the name of *King*. These are generally reckoned five in number, though the three first only are considered by many of the Chinese as properly entitled to the name.

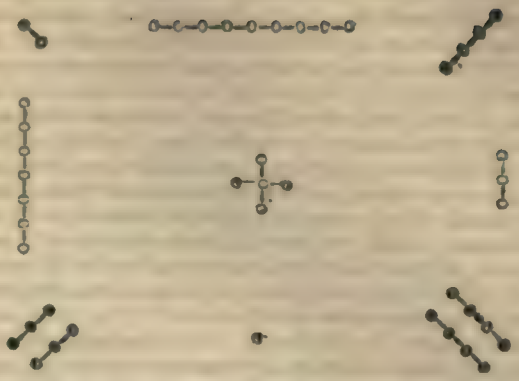
[illegible]

1. Y-king, or the explanation of the lines of Fo shee. These lines are supposed to be the most ancient piece of Chinese writing, and are ascribed to the pen of Fo-shee, who is said to have observed them upon the back of a dragon; and are regarded, most absurdly, by many Chinese, as the basis of their written character. They are called Kooa, and are supposed to contain the principles of all things that exist, the formation of the universe, and the whole system of nature. The emperor Ven-vang attempted, by short notes, to give some explanation of this philosophical enigma, increasing the number of kooa from 8 to 64; his son Tcheoo-kang added a more ample interpretation; Confucius at length published a commentary, both upon the lines themselves, and upon the notes of the two emperors; and these several pieces form the contents of the Y-king. These lines seem, after all to be utterly incomprehensible, and to admit of no better interpretation than that of Mr Barrow, who considers them as nothing else than the school-boy's amusement of the magic square, in which the nine figures are arranged in such a manner as to make the number 15 in whatever way they are added.

This view of them may be rendered more intelligible by the following diagram from that author:—

Literature.

Lines of Foshee.



2. The Shoo-king, a collection of historical records of the earliest sovereigns of China, arranged and edited by Confucius; a book, which is regarded as divine, and the characters of which are all numbered; which teaches the strictest stoical morality, and which is the basis of the government and laws of China; which inculcates, under the form of history, the reciprocal duties of the prince and people, and the perusal of which is accounted the most improving study for the emperor and his ministers.

3. Shee-king, a collection of odes, and maxims, but so full of obscure metaphor, as to render a translation very difficult and uncertain.

4. Lee-kee, or a compilation of laws, ceremonies, usages, and maxims of Confucius, collected by the disciples of that philosopher.

5. Tchun-tsieoo, consists chiefly of annals of the kingdom of *Loo*, composed by Confucius.

There is also another class of books called King, of an inferior order.

1. The See-shoo, or four books of Confucius, called Ta-hio, or *sublime science;* Tchong-yong, or *just medium*; Lun-yu, or *words and discourses*, and the works of the philosopher Meng-tse.

2. Two books upon the rites of the dynasty of Tcheoo.

3. Books on filial piety, and certain poetical compositions, entitled Tsoo-tse, and Shan-hay-king.

4. The three ancient commentaries upon the book of Tchun-tsieoo.

5. The works of the historian Se-ma-tsien, and of some other authors.

Translations of Chinese works.

The greater part of the *King* have been translated and published in France by the Jesuit missionaries. But their translations are censured by those who are skilled in the subject, as having too much of the European character and style engrafted upon the Chinese originals, and as neither conveying an accurate idea of the original, nor a certain transcript of the meaning. As far as can be judged from the portion of these books which is intelligible, they impart very little knowledge either of the ancient or modern state of China.

Among the principal Chinese productions which are known in Europe may be mentioned the Ta tsing hoei-tien, which contains a compendium of the existing laws, with all the forms and regulations of the several departments of the state; of the rites and ceremonies of the empire, the administration of justice, the system of revenue and finance, &c. and which would afford, it is supposed, the most important information respecting the state and government of China; the Tay-tsing-ee-tung-tse, a complete Encyclopædia of arts and sciences, extending to 200 volumes, and published by the authority of the Emperor Kien-long; the Tong-kien-kang-moo, a general history of China, translated into French by Father Mailla, in 14 volumes; the Hao-kioo-tchuan, or pleasing history, which has been rendered into English from a Portuguese version by Dr Percy, and which is considered as at once one of the most faithful translations of a Chinese work, and one of the best fitted to convey a correct idea of the sentiments and manners of that people.* In consequence of the early and frequent intercourse, which subsisted between the Chinese and Hindus, there is said to be an immense number of works to be found in the temples of Fo, translated from the Sanscrit language into the Chinese.

Chinese authors. But though China abounds in works of erudition, these are seldom produced by the labours and resources of private individuals. The youth of the country are so continually occupied with their studies and examinations in their progress to office, and so entirely engaged with the duties of their place, when they have obtained appointments, that they have no leisure for literary pursuits. The constant and regular removals also of the mandarins from one station to another, and the uncertainty of a son being able to preserve the rank of his father, prevent the accumulation of private libraries; and though there are generally large collections of books and manuscripts stored by order of government in the monasteries of the bonzes, by way of security, to which all the literati have free access; yet the greater part of these convents are at a distance from the cities, frequently situated in the midst of mountains, and thus not easily within the reach of literary men. **Imperial college.** All the great works, therefore, of Chinese production, have proceeded from the Han-lin, a kind of college, or body of select literati, who have their residence at court, and who act as secretaries to the emperor, or as superintendants of the imperial schools. The greater part of them, however, are lodged in a large and commodious building, where they are surrounded with all the literary treasures of the empire, and where they labour in concert, and without interruption, on such works as the emperor orders to be executed. As each of these has his proper employment, as all of them are interested in the general result, and as there is no restriction in point of expence or time; their united productions possess a degree of perfection, which is rarely found in the works of a private author. From this body proceed all the great historical collections, dictionaries, commentaries, &c.; and these works, printed at the expence of government in a most magnificent style, are distributed by the emperor as presents to the princes of the blood, prime ministers, principal tribunals, governors of provinces, and public libraries. **Ordinary publications.** In other respects, there are few publications and little printing in China, except a multitude of temporary and trifling productions, which are poured forth every month from the presses at Pekin, and which are speedily circulated throughout the empire. These consist chiefly of almanacks and calendars; manuals of medicine and devotion, of rites and ceremonies, and rules of good-breeding; predictions of good and bad fortune; moral maxims from ancient sages, and the exhortations of the existing emperor; novels, romances, or moral tales; comedies and laughable stories, popular songs and fables; receipts for cookery or physic, and similar productions, which are generally sold at a cheap rate, and of which the Chinese are said to be great readers. Daily papers also are printed in the capital, containing private anecdotes, domestic occurrences, notices of sales, and the virtues of quack medicines; **Freedom of the press.** and to a certain extent the press may be said to be free, that is, not under the necessity of waiting, before publishing, for any licence or imprimatur. But the summary mode of punishing any breach of morality or good order provides a sufficient security against any licentiousness in the press, as not only the printer and vender, but even the reader of any libellous or pernicious publication, would be equally obnoxious to the bamboo. As the superior mandarins also are the sole judges of the limits to be observed in such publications, it may be said that there is, strictly speaking, no real liberty of the press, or of any thing else in China; and it would be certain ruin to publish the slightest reflection upon the conduct of government, or of its principal officers.

General education. As learning is so essential a requisite in China for admission to office, the more wealthy classes endeavour to give to their children the best education; and they find a sufficient number of preceptors in those students who are candidates for the title of doctor. The government provides teachers for the children of the soldiery, but supports no other seminary throughout the whole empire, except the imperial college at Pekin; to which the mandarins of the four first orders, resident in the metropolis, those of the three first orders resident in the provinces, and those of the first and second orders in the military class, are entitled to send one of their children; where, after an attendance of three years, they are capable of being admitted to inferior appointments. There is not a city or village, however, in China, where a school is not to be found; the elements of education may frequently be obtained at the low rate of two dollars per annum; and it has been calculated, that about one half of the people are able to read and write.

Poetry. It is said, that the Chinese literati, employed only in useful studies, and in the pursuit of office, put very little value upon poetical compositions, except as a mere amusement in moments of relaxation; but that, nevertheless, a taste for the perusal of verses is general in the nation, and that there are few of their writers, who have not devoted a part of their leisure hours to the muses. At the same time, it may be affirmed, that, according to all our received ideas of poetical composition, there is, in strict propriety of speech, no such thing as poetry in the Chinese language; and it is only by analogy, that the name can be applied to a particular species of their literary productions. The nature of the language precludes every thing that constitutes the essence of a poem. The energy and beauty of expression among the Chinese depends not upon any measured arrangement of sounds, but upon a skilful choice of written characters; and it may be said, that Chinese verses (the merit of which can be appreciated only by the learned) are addressed rather to the eye than the ear.

They designate their poetry by the appellation or character *Shee*, which is compounded of *Yen*, a word, and *Shee*, a temple, that is, *the words of the temple*; an expression which is supposed to imply, that such a style of writing is derived from a divine origin, and designed for sacred uses. As the word *yen* signifies also to speak, it has been farther conjectured, that the Chinese name of poetry may allude to the mode of speaking or teaching in temples, and may thus imply an imitation of that figurative style, which the ancient orientals in general employed in their religious instructions.

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* For a particular account of Chinese books, see *Histoire de l'Academie des Inscr. et Belles Lettres*, tom. 36, and Fourmont's *Grammat. Sinica*.

There are two kinds of Chinese poetry, which may be distinguished by the epithets written or painted, and oral or audible. The first is chiefly addressed to the eye, and its principal excellence consists in such a selection of characters as may convey the meaning in a concise expression, and, at the same time, excite agreeable associations in the mind of a Chinese reader. This latter effect is produced by bold metaphorical terms, by ingenious etymological combinations, or by allusions to the more important and interesting events in history. Many of these figures of speech, or rather figures of writing, are sufficiently fanciful, and far beyond the most profound conceits of our metaphysical bards. Others are so entirely applicable to Chinese history, as to be intelligible only to those, who are well acquainted with their ancient events and proverbs. Thus the head is denominated the *sanctuary of reason;* the ears, the *princes of hearing;* the eyes, the *stars of the forehead,* or *living pearls;* the nose, the *mountain of fountains;* the stomach, the *laboratory of aliments;* a mat for bedding, the *kingdom of sleep.* To *paint the tyger* is an expression which signifies *to drink hard;* because an ancient painter, when he was about to depict that ferocious animal, used to stimulate his imagination by copious draughts of strong liquor. A *peach tree and a spring of water* signify *the retirement of a sage;* because a Chinese philosopher, when fleeing from persecution, subsisted for some time in a desert place upon *peaches* and *water.* And the expression *she will not cut off her nose,* describes a gay widow in quest of a second match; because a beautiful widow is recorded in history to have mutilated her nose, that she might not be compelled to enter a second time into the married state.

In the second species, which is addressed to the ear, there are verses of a regulated measure, occasionally, though not uniformly, terminating in rhyme. In consequence of the small number of words in the spoken language, the poet is allowed to have one blank verse, at least, in every four of metre. This measured poetry is pronounced always in a recitative tone, which approaches to singing; and the particular notes, even, are frequently affixed to the written character. This tone is essential to the oral poetry; and, as there is frequently little rhyme in these compositions, the sole difference between verse and prose, often consists merely in the singing tone, with which the former is accompanied.

The most ancient and approved of the Chinese poetry is the *Shee-king,* mentioned among the sacred classics, which contains about 300 pieces, collected and revised by Confucius. They are chiefly of the oral species, and are generally repeated with musical cadences. As neither the expression of the visible character to please the eye, nor the accompanying tones addressed to the ear, can be represented to the European reader, it is not possible to give a fair specimen of such poetry; but curiosity may be gratified, to a certain extent, by the following extract from the *Shee-king,* which is a poetical record of a solar eclipse.

"Tché yué tché kiao
Tchou ge sin-mao
Gé-yeou ché tché
Ye koung tchè tcheou
Pei yue eul wei
Tsé ge eul wei
Kin tse shin min
Ye koung tcho ngai."

Literally translated.

"Tenth moon's conjunction, first day *sin-mao,* sun had eclipse: All portend bad. Whether sun covered or moon covered, people in general fear bad."

Among the first of modern Chinese poets is reckoned the late emperor Kien-long. One of his productions, entitled, "the praise of Mook-den," a city and district in Mantchoo Tartary, is of the written kind, and is a selection of characters, without measure or rhyme; but contains so much of the Mantchoo language, as to be unintelligible to a mere Chinese scholar. Another of his poems, "the Conquest of the *Miao-tse,*"* is of the second species, composed in a regular measure, accompanied by a kind of melody; and its 30 stanzas may be regarded as merely so many military bulletins, set to music, the first of which is as follows:

Nien se tchong tseoo ye tchoo shee
Moulan ing lee tee hong keo
Pen lai poo mo vouen koon pau
Shoo pouei kin siau vouen Kien-tchée.

Thus rendered verbatim.

Twenty-four middle time 8th month night 1st to 3d watch
Moulan camp banner letter brought red flag with 2 dragons
Principal made strange reward how could I believe army
Proclaim early morning nigh like see.

Thus Paraphrased by Mr Weston.

"It was on the 24th of the 8th moon, between the second and third watch, in the middle of the night, in the camp of Moulan, that they came to tell me of the arrival of a messenger from the army with a red flag. How could I believe, that, this night I should see the certain sign of victory, and have so early an occasion of proclaiming the glory and reward of my army."

Imperial receipt for infusing tea.

One of this emperor's most celebrated poems is an ode in praise of tea, or rather a receipt for the proper infusion of that beverage; which is thus translated by Mr Barrow.

"On a slow fire set a tripod, whose colour and texture shew its long use. Fill it with clear snow-water. Boil it as long as would be sufficient to turn fish white, and cray-fish red. Throw it upon the delicate leaves of choice tea, in a cup of yooe (a particular kind of porcelain). Let it remain as long as the vapour rises in a cloud, and leaves only a thin mist floating on the surface. At your ease, drink this precious liquor, which will chace away the five causes of sorrow. We can taste and feel, but not describe, the state of repose produced by a liquor thus prepared."

Ballads, &c.

The Chinese have their odes, elegies, eclogues, epigrams, satires, and even *bouts rimés;* and the common people are furnished with songs and ballads suited to their taste. These are frequently composed by their most distinguished writers, who have put into verse, for the use of the lower classes, their most celebrated moral maxims and rules of good breeding; and who vindicate the utility of these humble labours by the following proverb: "Though good grain should produce only straw, still it will benefit the soil by preventing the growth of weeds."

We add, from Mr Barrow, one of the most popular Chinese songs, entitled

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* This poem has lately been translated into English by Mr Stephen Weston.

Moo-lee-wha.

I.

1 2 3 4 5
Hau ye-to sien wha
6 7 8 9 10 11 12 13
Yeu tchau yeu jie to tsai go kia
14 15 16 17 18 19
Go pun tai poo tchoo mun
20 21 22 23 24 25
Twee tcho sien wha ul lo

II.

1 2 3 4 5 6
Hau ye to moo-lee wha
7 8 9 10 11 12 13 14
Man yuen wha kai soy poo quee ta
15 16 17 18 19 20
Go pun tai tsai ye ta
21 22 23 24 25 26 27
Tai you kung kan wha jin ma.

I.

1 2 3 4 5
How delightful this branch of fresh flowers!
6 7 8 9 10 11 12 13
One morning one day it was dropped in my house.
14 15 16 17 18 19
I, the owner, will wear it not out of doors;
20 21 22 23 24 25
But I will hold the fresh flower and be happy.

II.

1 2 3 4 5 6
How delightful this branch of the Moo-lee flower!
7 8 9 10 11 12 13 14
In the full pot of flowers blowing freely none excels it.
15 16 17 18 19 20
I, the owner, will wear this gathered branch;
21 22 23 24 25 26 27
Wear it, yet fear, the flower seen, men will envy.

Oratory.

The oratory of the Chinese is founded chiefly upon an imitation of their best ancient writers; and may be said to consist merely in an elevated style of writing, or to be the same as their poetry, without the musical notes. Its excellence consists in conciseness of expression, boldness of metaphor, a happy application of ancient maxims, and above all, in brevity of illustration. No superfluous ornament, or useless expression, or accumulation of inconclusive argument, is admitted in such compositions; and the best orations are those, which produce their effect, without exceeding the compass of a few lines. In what may be called the academical compositions of the literati, who are aspiring to degrees, there is a sufficient display of false eloquence, of unnatural images, unmeaning words, and excessive brilliancy; but such orators are denominated *golden mouths* and *wooden tongues* by their best judges, who approve only what approaches to the elegant precision and manly simplicity of their ancient authors. The Chinese rhetoricians pretend to distinguish oratory into an inconceivable number of varieties; but the designations of the several kinds are merely epithets, expressing the quality of the piece, or the disposition of its author. Thus they speak of *the eloquence of things*, which consists in the power of truth; *the eloquence of sentiment*, which is the effusion, as it were, of the orator's soul; *the eloquence of candour*, which banishes doubt or suspicion; *the eloquence of combination*, which is the fruit of much study; *the eloquence of wonder*, which subdues reason by astonishing the imagination; *the eloquence of singularity*, which contradicts received truths, and attracts by the appearance of original discoveries; *the eloquence of subtleties*, which is wrapt up in obscurities; *the eloquence of depth*, which produces reflection by its weighty instructions; *the eloquence of grandeur*, which approaches to the sublimity of the ancient classics, &c. Strictly speaking, indeed, there is no real oratory in China, as there is no oral address in the presence of judges or assemblies. It is only by memorials, petitions, and remonstrances presented to the emperor, or his tribunals, that a rhetorician can influence any proceeding; and, in no instance do the Chinese admit of those powerful modulations of voice, expressive gestures, and animated declamations, which contribute so much to the success of European orators. Affecting always to be grave and composed hearers, they wish their understanding to be calmly and gradually enlightened, and would be offended by any appearance of a wish to impress their feelings.

Drama.

The Chinese drama possesses none of the requisites of the European stage; observes none of the unities of time, place, or action; makes no distinction between tragedy and comedy; and exhibits the whole life of the hero, or even the duration of a whole dynasty, without any regard to regularity or probability in the plot. Every piece is generally divided into several parts or acts; every actor, when he comes forward, begins by informing the audience of his name, and the character which he is to support; and the same person generally performs several parts in the course of the piece. The dialogue, like the Italian opera, is delivered in a monotonous kind of recitative, with occasional risings and sinkings of the voice, to denote the emotions of the speaker; and the more violent passions of anger, joy, grief, despair are always expressed by singing. There is generally an accompaniment of music throughout the representation; and the pauses, particularly, are filled up by a confused crash of gongs, drums, trumpets, and cymbals. They have no scenery, but what is produced by the awkward use of human beings to represent inanimate objects; and Shakespeare's "man with lime and rough-cast to present a wall." is far outdone by a heap of Chinese actors, piled like logs above each other, to imitate a wall in the storming of a city or castle. To assist the imagination of the audience, also, in conceiving some change of scene, an actor rides round the stage upon a stick, humming a song, in imitation of a person making a journey; or he imitates the action of a person opening a door, and ascending a step or stair, in order to imitate his passing from one apartment to another. Females are not permitted to appear upon the stage; but eunuchs or boys are employed in their stead.

Their select pieces consist of a hundred historical plays published in one work, and supposed to have been chiefly produced in the fourteenth century. Only one of these, "the Orphan of China," translated by Father Premare, has appeared in a European version; and was the basis of Voltaire's tragedy of the same name. It is not considered, however, as a very faithful translation; and furnishes no proper specimen of the actual state of Chinese theatricals. The subjects of the more regular pieces are generally of a historical nature, referring to the more remote events, and represented in the ancient costume of China; and the catastrophe of the greater part, is generally the last paroxysm of a despairing lover, or the violent agitations of a criminal on the eve of execution. The Tartar Conquest is among the number of these representations; but there are no pieces founded upon events posterior to that æra. It has been affirmed by the French missionaries, that the ancient Chinese sages uniformly condemned theatrical representations; that they are rather tolerated than authorised by the existing laws of the country; that the modern literati rarely employ their talents in writing for the stage; and that even the editors of the Gazette would be subjected to censure and punishment, were they to debase its pages by any notices respecting their stage-players. Notwithstanding the excessive fondness of the Chinese for theatrical exhibitions, the office of comedian is so much despised by the people in general, that the managers of their theatres, or rather leaders of strolling companies, experience great difficulty in procuring a sufficient number of actors, and are frequently obliged to purchase, and to bring up children for the purpose.

Modern Chinese theatricals.

Their critics maintain, that the Chinese theatre has greatly degenerated since the Tartar conquest; and lament, like European censors, the depraved taste of modern times. It is said, that the principal personages of the empire have frequently private theatres in their houses, where they occasionally entertain their guests with more regular and established pieces; but the chief part of their public exhibitions, even in the presence of the court, consists of dancing, riding, wrestling, posture-making, and juggling tricks. The following description, by Lord Macartney, of the exhibitions on the emperor's birth-day, may be considered as a specimen of their higher style of performance. "The comedy began at eight o'clock, and lasted till noon." "The theatrical entertainments consisted of a great variety, both tragical and comical. Several distinct pieces were acted in succession, though without any apparent connection with one another. Some of them were historical, and others of pure fancy, partly in recitative, partly in song, and partly in plain speaking, without any accompaniment of instrumental music; but abounding in battles, murders, and most of the usual incidents of the drama. Last of all, was the grand pantomime, which, from the approbation it met with, is I presume considered as a first rate effort of invention and ingenuity. It seemed to me, as far as I could comprehend it, to represent the marriage of the ocean and the earth. The latter exhibited her various riches and productions, dragons, and elephants, and tygers, and eagles, and ostriches, oaks, and pines, and other trees of different kinds. The ocean was not behind hand, but poured forth on the stage the wealth of his dominions, under the figures of whales and dolphins, porpoises and leviathans, and other sea monsters, besides ships, and rocks, shells, sponges, and corals, all performed by concealed actors, who were quite perfect in their parts, and performed their characters to admiration. These two marine and land regiments, after separately parading in a circular procession for a considerable time, at last joined together and forming one body, came to the front of the stage, when, after a few evolutions, they opened to the right and left, to give room for the whale, who seemed to be the commanding officer, to waddle forward, and who, taking his station exactly opposite the emperor's box, spouted out of his mouth into the pit several tons of water, which quickly disappeared through the perforations of the floor. This ejaculation was received with the highest applause; and two or three of the great men at my elbow desired me to take particular notice of it, repeating, at the same time, "Hao kung haô, charming, delightful." "We had now wrestling and dancing, tumbling and posture-making, which appeared to us particularly awkward and clumsy, from the performers being mostly dressed according to the Chinese *costume*; one inseparable part of which is a pair of heavy quilted boots, with the soles of an inch thick. The wrestlers, however, seemed to be pretty expert, and afforded much diversion to such as were admirers of the *Palæstra*. A boy climbed up a pole or bamboo 30 or 40 feet high, played several gambols, and balanced himself on the top of it in various attitudes; but his performance fell far short of what I have often met with in India of the same kind. A fellow lay down on his back, and then raised his feet, legs, and thighs, from his middle perpendicularly, so as to form a right angle with his body. On the soles of his feet was placed a large round empty jar, about four feet long, and from two and a half to three feet diameter. This he balanced for some time, turning it round and round horizontally, till one of the spectators put a boy into it, who, after throwing himself into various postures at the mouth of it, came out and sat on the top. He then stood up, then fell flat upon his back, then shifted to his belly; and, after shewing a hundred tricks of that sort, jumped down upon the ground, and relieved his coadjutor." "A man came forwards, and after fastening three slender sticks to each of his boots, took six porcelain dishes of about 18 inches diameter, and balancing them separately at the end of a little ivory rod which he held in his hand, and twirling them about for some time, put them, one after the other, upon the points of the six boot-sticks above-mentioned, they continuing to turn round all the while. He then took two small sticks in his left hand, and put dishes upon them in the same manner as upon the other, and also one more upon the little finger of his right hand, so that he had nine dishes annexed to him at once, all twirling together; which in a few minutes he took off one by one, and placed them regularly on the ground without the slightest interruption or miscarriage." But in all these performances, and many others of the same kind, his Lordship declares, that he witnessed none at all comparable to the tumbling, rope dancing, wire-walking, and straw-balancing at Sadler's Wells; nor any feats of equitation in the style of Hughes and Astleys' amphitheatres. It is in fire-works alone, that the Chinese seem to excel all other nations in neatness, magnificence, and ingenuity of contrivance. "One piece of machinery," says Lord Macartney, "I greatly admired. A green chest, of five feet square, was hoisted up by a pulley to the height of 50 or 60 feet from the ground. The bottom was so constructed as then suddenly to fall out, and make way for 20 or 30 strings of lanterns, inclosed in the box, to descend from it, unfolding themselves from one another by degrees, so as at last to form a collection of at least 500, each having a light of a beautifully coloured flame burning brightly within it. This devolution and developement of lanterns (which appeared to me to be composed of gauze and paper) were several times repeated, and every time exhibited a difference of colour and figure. On each side was a correspondence of smaller boxes, which opened in like manner as the others, and let down an immense net-work of fire, with divisions and compartments of various forms and dimensions, round and square, hexagons, octagons, and lozenges, which shone like the brightest burnished copper, and flashed like prismatic lightning, with every impulse of the wind. The diversity of colours, indeed, with which the Chinese have the secret of clothing fire, seems one of the chief merits of their pyrotechny."

Similar exhibitions and theatrical entertainments were witnessed by the gentlemen of the Dutch embassy in 1795; in some of which, the officers of the court were themselves the performers. About the season of the new year the emperor made his appearance upon the ice in a sort of sledge, supported by figures of four dragons, and moved about by some of his chief mandarins, some dragging before, and others pushing behind. The four principal ministers of state were also drawn in like manner by inferior mandarins. Crowds of civil and military mandarins attended, some in sledges, some on skaits, and some amusing themselves at foot-ball upon the ice, the more expert of whom were rewarded by the emperor. The ball was then hung up in a kind of arch, and several mandarins passing it on skaits, shot at it as a mark with their bows and arrows. Owing to the form of their skaits, which were cut short under the heel, and the fore part turned up at right angles, the skaiters could not easily stop themselves on a sudden; and hence, when they came near to the side of the ice, or towards the quarter where the emperor was stationed, they tumbled in heaps one over the other. The other entertainments, exhibited, consisted chiefly of contortions of the human body, by posture makers and rope-dancers, with the addition of a kind of pantomime hunt, which was performed by men dressed in skins, and going on all-fours, to represent wild beasts, and by boys habited like mandarins as hunters; an exhibition, which was observed to afford great entertainment to the emperor and the ladies of the court, who were concealed behind Venetian blinds in an upper apartment. An entertainment was given after an eclipse of the moon, in which, besides a multitude of juggling tricks and puerile sports, there was likewise a pantomimical representation of the battle between the moon and the great dragon, who causes the eclipse. In this lunary contest, two or three hundred priests, bearing lanterns at the end of long poles, performed numerous evolutions, dancing and capering about the plain, or jumping over chairs and tables, to the infinite delight of the emperor and his courtiers.

Not only are the theatrical exhibitions of the Chinese thus mingled with such low absurdities and puerilities, as are little superior to the tricks and puppet-shows which amuse the populace at an English fair, but every species of obscenity and indecency also is brought upon their stage in so shameless a manner, that the most unpolished European seamen have often been known to leave the Canton theatres in disgust. The exhibitions, indeed, to which foreigners are admitted in this city, are asserted to afford no proper criterion for judging of the Chinese public places in general; but to be considered by the natives themselves as sufficiently good for the amusement of the despised barbarians of other countries. As it is not, however, pretended by those, who allege this palliation, that none but foreigners are allowed to be present at such representations, it clearly indicates a depraved taste, at least in the inhabitants of Canton, when such indecencies are exhibited in places of entertainment, which are open to the whole community.

ARTS AND SCIENCES. Science, strictly so called, can scarcely be said to exist in China; and not one of the arts has attained a high degree of cultivation. In the more useful arts of life, excepting agriculture, or rather horticulture, (for it is chiefly with the hoe and spade that the land is tilled,) they have made little progress; and in what are called the fine arts, or those which indicate taste, with the exception of the embellishment of garden ground, they are still in a state of barbarism. In those, which approach rather to the character of manufactures, pottery is the only one, in which they can be regarded as eminent, and that chiefly owing to the peculiar excellence of their materials; and in those, which discover great ingenuity, their pyrotechny alone surpasses that of all other nations.

Astronomy. Of all the sciences, astronomy is the most valued, but least understood by the Chinese, and they profess to trace back their acquaintance with its principles to the most remote periods. According to the Shoo-king, the revolutions of the heavens, and the length of the solar and lunar years, were known in the time of Yao, about 2357 years before Christ. Their astronomical observations, however, recorded during the long period which their annals embrace, are so exceedingly few in number, so obscurely detailed, and so doubtful in their whole circumstances, as to afford no evidence of the skill of the observers. But, however attentive and persevering their observance of the heavens, they have not on that account become more able astronomers; nor can it be said of them, as it has been of other nations, that their rage for astrology has contributed to their progress in astronomy. It does not appear that they were ever able to calculate eclipses; and their tables on this subject are mere registers of what has happened, and not predictions of what is to take place, founded upon astronomical computations. They are utterly ignorant even of the first principles of the science, and have nothing in their stead, but a confused jargon about judicial astrology. They still maintain all the vulgar notions, which their great philosopher inculcated more than 2000 years ago, namely, that the heaven above is round, and the earth a square fixed in the middle, with the element of water placed on the north side of it, that of fire on the south, that of wood on the east, and that of metal on the west; and that the stars are all stuck in the blue vault of the firmament, at the same distance from the earth. **Mathematical board.** From the earliest periods of their history, indeed, an astronomical board has formed one of their official departments in the government; but the principal, and almost the only business of this board, is to prepare a national calendar, in order to mark the returns of the seasons, to fix the dates of the public ceremonies, and to point out the most suitable times for important undertakings. A committee is annually appointed to superintend the astrological part of this calendar, which is chiefly composed of predictions respecting the weather, a list of all the lucky or unlucky days of the year, and a notice of the most proper times for taking medicine, for marrying a wife, for entering upon a journey, for laying the foundation of a house, &c. The astronomical part of their function, however, comprising tables of the sun's rising, of the new and full moon, of the motions of the principal planets, and of the moon's conjunctions with these luminaries, is generally committed to foreigners; and whenever the Chinese members have been left to their own resources in this branch of their duty, they have been involved in the grossest blunders. In the 13th century, when Gengis Khan first entered China, and his successor Kublai Khan conquered the country, their national almanack was found to be in the greatest disorder; and the conqueror, by inviting to his dominions learned Greeks from Bactriana, Mahommedan and Christian missionaries, succeeded in procuring their chronology to be adjusted, their astronomical observations to be rectified, mathematical instruments to be imported, and the whole empire to be properly surveyed and divided. The greater part of those learned men seem to have been expelled from the country, when the Tartars were driven from their sovereignty; and when China was again subdued by its present rulers, the Mantchoo dynasty, it was found that the calendar had become full of errors. Some German Jesuits, with Father Adam Schaal at their head, had been appointed to assist the tribunal of mathematics; but, when these were cast into prison in 1664, the whole astronomical system was again thrown into such confusion, that Father Verbriest, upon being appointed by the government, in 1669, to correct the calendar, found it necessary to cut off a whole month. Of late years, this office of regulating the national almanack has been committed to the Portuguese missionaries; and three of them were entrusted with this important charge, at the time of Lord Macartney's embassy.

Distribution of the planets.

The Chinese reckon seven planets, including the sun and moon. The sun is represented by the figure of a bird within a circle, and presides over the year and the seasons. The moon is figured by a rabbit pounding something in a mortar, and presides over the division of time. The other five are, *Too*, the earth, which corresponds with Saturn, and reigns to the end of summer; *Mo*, wood, which corresponds with Jupiter, and presides over the spring; *Ho*, fire, which corresponds with Mars, and presides over the summer, mournings, and public works; *Kin*, metal, which corresponds with Venus, and presides over the autumn; and *Shooy*, water, which corresponds with Mercury, and presides over the winter. They have arranged the stars under different constellations, the names of which bear a reference to the different parts of the government and empire of China; and the firmament is divided into four quarters, each of which contains seven of these constellations. These twenty-eight constellations compose the zodiac, which they call *the yellow way;* and the equator, which is named the *flesh-coloured way*, is divided into twelve palaces, or portions, of thirty degrees, each of which is again divided into two, thus forming the twenty-four Tsie-kee, which refer to the different seasons and periods of the year.*

Division of the year.

They divide the year into twelve moons, or lunations, and make an intercalation of one month in the 3d, 6th, 9th, 11th, 14th, 17th, and 19th year, in a period of nineteen years. They begin the year with the first new moon which appears after the first degree of Aquarius; and the whole consists of 354 days. The months consist some of 30, and some of 29 days; and are divided, sometimes into four, and sometimes into three parts. The day is divided into twelve hours, each, of course, containing two of ours; and the first begins at 11 o'clock in the evening. Each hour is divided into two half-hours, and each half into four quarters. The hours have their appropriate appellations, and bear also the names of different animals, viz. the rat, the ox, the tiger, the hare, the dragon, the serpent, the horse, the sheep, the ape, the hen, the dog, the hog. The night is farther divided into five watches, which vary in length, according to the duration of the darkness, and the first of which begins about 8 o'clock of the evening.

Astrological notions.

The planets are considered by the Chinese as influencing the events of human life, and much is made to depend upon their appearance and positions. When the colour of the sun is pale, it is a token of approaching calamities, or of the death of a prince; and its eclipse is understood to be necessarily followed by rebellions. Hence it has been justly remarked, that, as the persons appointed to observe the heavens, will naturally wish to find as few ominous aspects as possible, and, consequently, must make their observations under the strong influence of superstitious prejudices, astronomical science must always be in a very low state in China. The occurrence of an eclipse is there viewed as an event affecting the stability of the empire, or the safety of the prince; and the whole nation are assembled to the spectacle by express orders of the government. The officers of state give public notice of the time when such a phenomenon is expected, according to the calculations of the national almanack. The public functionaries put on mourning; and all business is suspended. The members of the mathematical board, and other learned men, assemble at the palace to observe the agreement of the eclipse with the prediction; and, as soon as the observation commences, they fall down upon their knees, bowing their heads repeatedly to the ground; while the gongs, trumpets, kettle drums, and all kinds of noisy instruments strike up at once, to frighten the dragon which is supposed to have beset the suffering luminary. It is related, that, on one occasion of this nature, the intervention of clouds having prevented the eclipse from being seen, the Chinese grandees hastened to congratulate the emperor, upon the regard which heaven had testified for his virtues, in sparing him, at this time, the affliction of beholding the sun under an eclipse.

Eclipses.

Geography.

Their knowledge of geography is equally defective; and they consider the earth as a plain square surface, of which their country occupies the central part. Even their plans and charts of their own empire were utterly rude and incorrect sketches, without either rule or proportion, till they were provided by the indefatigable labours of the Jesuits with their present accurate maps and surveys.

Arithmetic.

They are totally ignorant of algebra and geometry; and their arithmetic is altogether a mechanical system. By the most learned, as well as the most illiterate of the people, all their calculations are performed by means of a machine, apparently of Chinese origin, called in the common dialect Swan-pan, and, in the mandarin pronunciation, Soen-poen. It bears some resemblance to the Abacus of the Romans, and consists of ten rows of balls, strung upon copper wires, and divided in such a manner, that the upper part of each row contains two balls, each of which is reckoned five; while the inferior portion has five balls, each of which represents an unit. By the aid of this instrument they produce a kind of decimal arithmetic in a very easy and expeditious manner; of which a figure and description may be seen in Barrow's *Travels to China*, p. 296. The Chinese do not express numbers by figures; but write the sums at length in words; except in what may be called their current hand, which frequently abridges the characters; and, in which, for instance, instead of the two words or characters, San-she, 30, they would draw three perpendicular lines crossed by another in a horizontal direction.

Natural philosophy.

They have a practical knowledge of some of the most obvious effects produced by natural causes; but no branch of physical science is pursued as a subject of investigation. They have very little acquaintance with pneumatics, hydrostatics, electricity, or magnetism; and, except making concave and convex lenses of rock crystal, for spectacles or burning glasses, they are equally ignorant of optics. The single microscope, indeed, was found in use among them; but they are unacquainted with the art of assisting vision by a combination of lenses.† A convex lens is very commonly carried by individuals to light their tobacco pipes; but they have not sufficient knowledge of its properties to enable them to appreciate the scientific improvements of these articles by Europeans; and they expressed no admiration of the immense and powerful burning glass, which constituted one of the presents to their emperor from the British embassy. See BURNING INSTRUMENTS, p. 142.

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* Of all these particulars, see a minute account in De Guignes' *Voyage a Pekin*, tom. ii. 423, &c.

† Even in making spectacles, they grind the glasses at random; and when the purchaser chooses such as he conceives most fitted to his vision, he cannot be certain that both the glasses have the same focus.

Chemistry.

They are totally ignorant of chemistry, as a science; but are acquainted with many of its practical applications. The process of smelting iron is well known among them; and they produce a very thin and neat kind of cast iron ware, which they render less brittle by annealing in heated ovens. They are able also to convert the same metal into an inferior kind of steel, but their manufactures of wrought or malleable iron are extremely deficient, both in quality and workmanship. In the other metals, their skill is very considerable, and they produce a great variety of the neatest trinkets and jewellery. They display great ingenuity in cutting different kinds of stone into groups of figures and landscapes, in cutting and polishing the harder kinds of which, they make use of the powder of rock crystal. They have a knowledge of the effect of steam as a more powerful instrument of heat than water, and employ a kind of Papin's digester for softening horn; but they have no acquaintance with its elastic nature, and make no application of it to machinery. Though utterly devoid of all theoretical notions of colour, they know how to extract from vegetable, mineral, and animal substances, a variety of the most brilliant colouring materials, which they have the art of mixing up in every possible shade and tint, and which they can communicate to cloth, paper, and porcelain, in the richest and most lively hues. They are well versed, also, in the practice of distillation; and prepare from various kinds of grain, especially from rice, an ardent empyreumatic spirit, which they call *San-tchoo*, and which is said to have some resemblace to the whisky of Scotland. Other instances of their practical application of chemical principles will occur under the head of Manufactures.

Medicine.

The Chinese are said to have directed their attention to the cultivation of the healing arts, from the most remote periods; and to possess a mulutude of writings on that subject. But, however these assertions may be received, it is certain, that they have made very little progress in this most important science; that there are no schools of medical instruction in the empire; and that the profession is held in no degree of estimation. Every person is free to exercise the trade of a physician; and those, who wish to be duly prepared for practice, place themselves under the tuition of one of the faculty, who communicates his secrets and his skill. The eunuchs about the palace are generally accounted the most eminent practitioners, and the priests, for the most part, exercise the profession; but the great proportion of acting physicians are to be found among the lower classes of the community, and the multitude of quacks and nostrum venders is said to be immense. The Chinese physicians are altogether ignorant of physiology or the theory of the human frame, as well as of pathology, or the causes and symptoms of disease. They are utter strangers also to every branch of anatomy, as it would both be contrary to all their customs, and wholly impracticable for the weak nerves of a Chinese to open a dead body. It has been ascertained, in opposition to the assertion of the missionaries, that they are entirely unacquainted with the circulation of the blood; and their whole art is limited to the study of the pulse.

Theory of medicine.

According to their theory of medicine, vital heat and radical moisture are the two natural principles of life; the former of which they suppose to have its seat in the heart, lungs, liver, and kidneys; while they place the latter in the intestines, the number of which they reckon to be six. Of this heat and moisture, the blood and spirits are the vehicles, conveying them from their respective seats to the other parts of the body. Every disease, they imagine, acts successively upon the heart, the liver, the lungs, the stomach, the entrails, and the kidneys; and its passage from one of these parts to another, produces a crisis, of which it is of the utmost consequence to know how and when to take the advantage.

Diagnostics.

They pretend to judge of the state of a patient, and to determine the nature of his disease by the sound of his voice, the colour of his face and eyes, and the appearance of his tongue, nostrils, and ears; but it is upon the state of the pulse, that they found their most infallible prognostics. They suppose, that every particular part of the body has a separate pulse of its own, and that each of these again has a sympathetic pulse in the arm. The skill of the physician consists in discovering the seat and nature of the disease, by ascertaining the prevailing pulse in the body, in consequence of feeling the corresponding pulsations at the wrist. The pulse of the patient, therefore, is always examined with the greatest formality and deliberation; and the physician proceeds, without asking any questions, to inform the patient where he feels pain, what parts of his frame are affected, and in what manner the disorder will terminate. But, before pronouncing his opinion, he takes care to become secretly acquainted with the case of the patient; as his reputation always rests more upon assigning the true cause of the disease, than upon his success in removing it. That their information is not derived merely from the indications of the pulse, is manifest from the modes in which the female pulse is felt. As it would be contrary to all sense of propriety in China, for a stranger to touch the hands of a woman, a silken cord is fastened to the wrist of the sick lady, and passed through an opening in the wall to another apartment, where the doctor, by applying his hand to the string, pretends to distinguish the beats of the pulse. Like all oracular personages, however, unless they have been able, by other means, to learn the feelings of the patient, they generally ascribe the disorder to a cause of universal application, viz. to Fong-shooy, that is a good or bad fortune, and to heat or cold.

Mode of feeling the pulse.

Medical writings and practice.

The best of their medical treatises are mere herbals specifying the names, and qualities of plants; and their prescriptions consist chiefly of cordials extracted from fruits and herbs, and of strict regulations in point of diet. Their principal remedies from the vegetable kingdom are ginseng, prepared in seventy-seven different ways, rhubarb, China-root, and tea; from the animal kingdom petrified crabs as an antidote against all kinds of poison, musk, snakes, beetles, centipedes, the aurelia of the silk-worm, and other insects, the flesh, gall, skin, bones, and ivory of the elephant, the flesh, fat, milk, hair, and even the dung of the camel; from the mineral kingdom, saltpetre, sulphur, native cinnabar, &c. Opium is more frequently administered as a cordial to raise the spirits, than as a remedy against disease.

Surgery.

Their surgery, it may easily be conceived, is equally defective; and consists chiefly in setting a simple fracture, reducing a dislocation, drawing blood by scarifying or cupping, and sometimes burning the skin with hot pointed irons, or puncturing it with silver needles, and then setting fire to the leaves of certain plants, especially of mugwort, laid upon the place. Various other chirurgical operations, cleansing the ears, cutting corns, pulling the joints to make them crack, twitching the nose, and beating on the back, are performed by the barbers.

They are so afraid of cutting instruments, that even blood-letting with the lancet is never practised; and still less is amputation in any case attempted. Even the most simple operation is seldom undertaken, not only owing to the ignorance of practitioners, and the timidity of the patient, but in consequence, also, of the dread of an existing law, by which it is enacted, that if a wounded person be taken under any one's care with a view to effect his recovery, and if he should happen to die under his hands, then, unless the physician or friend can produce undeniable evidence how the wound was inflicted, and that the sufferer survived it 40 days, the person in whose hands he was found at his death, is made responsible for his life. So low, in short, is the state of the healing art in China, that the emperor of that extensive, populous, and wealthy country, according to the opinion of an eminent physician (Dr Gregory), could not command in his whole dominions, such medical aid as a smart boy of 16, who had been apprentice for one year to a well-employed Edinburgh surgeon, would be able to afford.

Architecture.

The Chinese architecture, bears no resemblance to that of Europe; and is not easily described by the usual terms of art. Their houses in general have nothing remarkable in their external appearance, and even their public edifices are distinguished rather by their extent, than their magnificence. Their whole style of building is represented by intelligent observers as extremely slight and ill-proportioned, inelegant in the design, and clumsy in the execution. All their dwellings are supposed to have been originally constructed after the model of a tent, with a carved roof, and wooden pillars round the brick wall, in imitation of the poles which support the sides of the tent. The external form and aspect of all the houses are extremely similar; and the habitation of a grandee in the capital is distinguished from that of a tradesman, chiefly by being surrounded with a high wall, and by occupying a greater space of ground. The dwellings of the peasantry, indeed, are in general extremely wretched, and little better than huts, consisting of low brick or earthen walls, covered by a slender roof of straw or of reeds. The habitations of the ordinary inhabitants in cities are confined within narrow limits; and a small court with two or three low-roofed apartments, forms the lodging of a whole family. The walls are generally of wood, occasionally of brick, but rarely of stone; and are neither solidly constructed, nor properly founded. The roof is commonly composed of tiles, formed in the shape of a canal, and those which are placed at the lower extremity, are, for the most part, curiously wrought and differently shaped. The lower stories are raised a little above the surface of the ground to avoid the moisture, and are paved with bricks or square tiles. The second flats are chiefly employed as store-rooms, and the stairs, in constructing which the Chinese architects are extremely unskilful, are little better than upright ladders.

Ordinary houses.

The houses of the more wealthy are distinguished by their large courts, galleries of communication, and variety of gates. The ground plot of 300 or 400 feet is laid out into ten or twelve courts paved with tiles. In some of these courts are three or four tent-shaped houses, standing upon stone terraces, which are about three feet above the level of the pavement; and from each of these apartments and courts are galleries of communication, consisting of colonnades of red wooden pillars resting on stone, leading to the adjoining parts of the habitation, so that every part of it may be visited without being exposed to the sun or air. The floors of the apartments are paved with bricks or clay; the ceiling is formed of bamboo laths covered with plaister, or is left altogether open without any thing to conceal the rafters. The windows are without glass, but are furnished with oiled paper, horn, silk gauze, or pearl shell, as a substitute. The walls are generally whitened with lime made from shells, or covered with white paper; and some of the rooms have holes in the corners, by way of fire places, from which the heat is conveyed through flues in the walls, or under the floor. The apartments of the ladies have frequently two stories, the uppermost of which have often no light, and are seldom so good as the common garrets in England. The furniture consists of a table, a few clumsy chairs of varnished wood, which on days of ceremony are covered with red cloth, some porcelain dishes filled with lemon trees or other shrubs, copper vessels for burning perfumes, and lanterns of various forms, made of paper, silk, ivory, or horn, and sometimes ornamented in a very expensive manner. Looking glasses are very rarely found in Chinese apartments, and little attention appears to be paid to internal decorations. Among the higher ranks, the beds are large and splendid, the posts gilded and adorned with sculpture, the curtains of fine gauze in summer, and silk in winter; but, in most cases, especially in the northern provinces, the beds are merely benches in the wall, constructed of brick, and heated by a stove on one side, the fire of which is frequently lighted from without. These beds, which are larger or smaller, according to the number of the family, are frequently covered with mattrasses during the night, which are replaced by a mat or carpet through the day, and the bed then becomes a kind of couch, upon which the family sit at work.* In the courts, are generally placed pots of flowers and shrubs, or jars filled with water, containing a variety of small fishes; and these courts are sometimes roughened with rocks and excavations in imitation of nature, and upon their ledges or projecting points, pots of shrubs and stunted trees are carefully distributed. A water closet, or suitable place of retirement, is not to be found in any Chinese dwelling or city; but large earthen jars, with narrow tops, are used for the purpose, and sometimes merely a stick, placed across a hole in a corner, is made to answer the end. The principal attention is paid to the position and construction of the gates, which in a great house are generally three in number, of which the middle one is the most magnificent, and is only opened for the admission of strangers of rank, or for the use of the master of the house on occasions of ceremony.

Apartments of the palace.

The lodgings, assigned to some of the gentlemen in the train of the British embassy, consisted of three or four rooms in a small court, surrounded with a wall, as high as the roofs of the buildings. Each apartment was about twelve feet square, the walls completely naked, the ceiling broken in, the lattices of the windows covered in some places with paper, and the doors made of old bamboo screens. In one of them, was an old table with only two or three chairs; and, in the rest, nothing but a little raised platform of brick-work, upon which were laid mattrasses to form a bed. Yet these rooms were within 200 yards of the great hall of audience in the imperial palace at Pekin; and had been the apartments of a great man, or officer of state. The greater part of the other buildings, within the precincts of the palace, were equally miserable hovels; and even the dwelling of the emperor himself, when divested of the painting and gilding, is pronounced by Mr Barrow to be inferior in solidity and furnishing to the barns of a substantial English farmer. The principal hall of audience in this palace was about 110 feet in length, 42 in breadth, and 20 in height. It stood upon a platform of granite, raised about four feet above the level of the court. A row of large wooden pillars surrounded the building, and supported the projecting roof. A second and corresponding inner row, with brick work between the columns to the height of four feet, formed the walls of the apartment. The spaces, above the brick work, were filled with a kind of lattice-work, covered with large sheets of oiled paper, and were capable of being thrown open on public occasions. The wooden columns had no capitals, and no other architrave, than the horizontal beam, which supported the rafters of the roof. Close to this beam, and between the upper parts of the columns, was a broad screen of wood painted with the most vivid colours and interlarded with gilding, the whole being covered with a net-work of wire to keep off the birds. The floor was paved with grey marble flags laid chequer-ways; and the ceiling was painted in circles, squares, and polygons variously coloured, and whimsically arranged. The throne, made entirely of wood and admirably carved, was placed in a recess, and supported by pillars of a red colour. On each side of it, stood a circular fan, made of the wings of a pheasant and mounted upon long polished poles of ebony. A pair of brass kettle drums, and of ancient procelain vases, two large paintings, a few volumes of manuscripts, and a table at one end, supporting an old English chiming clock, composed the whole furniture of this state apartment. The other edifices in the palace surpassed the ordinary buildings chiefly in their magnitude. Their walls were higher, their roofs of greater expanse, their wooden pillars of larger diameter, their painting and gilding more abundant, but none of them exceeded one story in height, and they were all equally unprovided with grates, stoves, curtains, looking glasses, sofas, bureaux, chandeliers, book cases, prints and paintings, and the other numerous elegancies and conveniences of furniture in European habitations.

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* The bedding consists generally of matting made of reeds or bamboo; a cylindrical wooden pillow, covered with leather; a kind of rug or felt blanket, made of the hairy wool of the broad-tailed sheep, not spun and woven, but beaten together as in the making of hats; and sometimes a mattrass stuffed with wool, hair, or straw.

Temples and pagodas. The temples are constructed upon the same plan as the houses, with the addition of a second, and sometimes of a third story, one above the other; and their wooden pillars are generally of larch fir, without any fixed proportions, invariably painted red, and sometimes covered with a coat of varnish. The pagodas, which are frequently composed of five, seven, or nine rounds or roofs, but always an uneven number, and which are from 80 to 160 feet in height, are the most striking objects in China; but are commonly so ill constructed, and with such bad materials, that they soon fall into ruins. They are larger or smaller, according to the importance of the cities, in the neighbourhood of which they are erected. It has been conjectured, from this circumstance, that they were originally built as signal stations. They sometimes appeared as appendages to the temples, though never used themselves as places of worship; and they seemed frequently to have been constructed in different parts of the country merely as embellishments to the grounds. The gentlemen of the British embassy observed none, in the whole of their progress, that could be considered as a late erection; but the greater part were in a ruinous state; and the specimen of a pagoda in the gardens at Kew is said to be equal to the very best of those which were noticed by them in China.

ity gates. The gates of the cities are, next to the pagodas, the most conspicuous structures, and are generally square buildings, rising several stories above the arched gateway, covered like the temples with one or more large projecting roofs, and frequently furnished with port holes in their sides, as described under the head of Fortifications.

Triumphal arches. The triumphal arches are the most numerous buildings, and are sometimes constructed of wood instead of stone. They are almost all of the same form, consisting of three arches or gateways, of which the middle one is the most elevated, ornamented with sculptured flowers and other figures, seldom exceeding 25 feet in height; and generally deficient in this respect, that their size is too massy in proportion to their elevation.

Sepulchres and tombs. In the cemeteries, or burying grounds, which are generally very extensive, there is a greater variety of architecture to be seen, than in the habitations which compose their cities. Sometimes the dead are deposited in houses resembling in every respect those of the living, except that they are of a diminutive size; and sometimes in an ornamented vault of a square, or hexagon, or octagon figure. Over the graves are erected also round, or square, or angular columns. But the most common structure in the case of persons of rank, consists of three terraces, one above the other, inclosed by circular walls. These terraces are ornamented with the figures of slaves, horses, cattle, and the other favourite objects of the deceased; while the entrance of the vault, which is in the centre of the uppermost terrace, is covered with the inscription or epitaph.

Bridges. There is great variety and beauty in the Chinese bridges, which are generally light and elegant to the view, but seldom constructed with much solidity or strength. Though they have a fine appearance when newly built, they soon begin to fail; and many of them were observed, by late travellers in that country, to be in such a state of dilapidation, as to be scarcely passable with safety. Many of them are altogether destitute of parapets or side-rails; and the Chinese government pays much less attention either to their original construction, or future repair, than has been supposed. The form of the Chinese bridges is very various. Sometimes they are quite level to the line of the road, and sometimes have the central arches considerably elevated, so that, in some of the smaller, bridges, there is an ascent at each end by easy steps. The arches are sometimes pointed like the Gothic, sometimes semicircular, sometimes of the horseshoe form; and their piers are occasionally of such extraordinary height, that the largest of their vessels, about 200 tons burden, can sail below the span of the arch without lowering their masts. The arches are, in some instances, formed of small stones pointing to a centre, as in Europe; and some of the vaults and arches in the great wall, built in this manner, are said to be well turned. But, in general, each stone is from five to ten feet in length, and is cut in such a manner as to form a segment of the arch; while, instead of a key-stone, ribs of wood, fitted to the convexity of the arch, are bolted through the stones, with iron bars fixed into the solid part of the bridge; or the curved stones are mortised into long transverse blocks of stone, which run along the whole depth of the arch. In many instances, the pillars only are of stone, and beams of wood are laid across to form a floor. One of the most remarkable of the more ancient Chinese bridges, seen and described by M. De Guignes on the road to Pekin, was at Tsotcheoo. It was divided into two parts by a small island, and its whole length was about 600 feet. The parapet was composed of slabs of marble about six feet long, fixed by means of grooves upon a number of small pillars about four feet high, and was decorated in different places with figures of elephants in marble, which appeared to be well executed. Another is mentioned by Mr Barrow, which consisted of 90 arches, thrown across the arm of a lake which joins the great canal, the central arches of which were about 30 feet high and 40 wide, and the whole length of which was nearly half a mile.*

The great wall.

The most stupendous work of masonry in China is the great wall, which separates the empire of China from northern Tartary. The date of this remarkable fortification is not easily ascertained, as certain parts of it appear to have been constructed at different times by the princes of Tchao and Yen, about 250 years before Christ; but it was in the reign of the Emperor Shi-hoang-tee, about 214 years before the Christian era, that these separate portions were united, and the wall completed in its whole extent. It is said, that every third man throughout the empire was summoned to assist in the building; that in those places, which were too steep to admit of horses or carriages being used, the workmen stood so close for many miles, as to be able to hand the materials from one to another; that, so diligently was the work carried on, that the whole was finished in the space of five years; but that, owing to the fatiguing journies, and change of climate, which the labourers from the distant provinces had to undergo, the greater part of those, who were employed in the work died before its completion. It begins at its eastern extremity with a strong bulwark, or large pile of stone, raised in the yellow sea, and proceeds westward through the provinces of Pe-tche-lee, Shansee, and Shensee, till it terminates near the city of Kin, on the yellow river, in the impassable mountains and sandy deserts, which begin from that point to cover the western frontiers. It is carried across rivers, vallies, marshes, and over the top of the highest mountains, without a single interruption in its course, except by a ridge of inaccessible mountains near the city of Suen, in the province of Pe-tche-lee, to which it is closely united on each side, and by the river Hoang-ho, which passes through it in its progress to the sea; while rivers of a smaller size find a passage by means of arches like those of a bridge, without breaking the line of building. Various calculations have been made respecting its extent; but it seems to be generally agreed, that, including its numerous windings, it cannot be estimated at less than 1500 miles in length. The foundation consists of large square stones laid in mortar; but the rest of it resembles much the wall of Pekin, and is composed of an earthen mound, cased on each side with brick or stone. The top is paved with flat stones, and is so broad in many places, that six horsemen may easily ride abreast upon it. Where it passes over steep rocks and elevated grounds, it is perhaps not above 15 or 20 feet in height; but in the vallies and plains, it is not less than 30 feet high; and in those places is rendered doubly defensible by means of large projecting square towers, at the distance of a bow-shot from each other. It has been remarked, however, that, towards its western extremity, it is merely a mound of earth, and very defective in various places; low and defenceless even in very assailable situations; while in other parts it is continued, at an unnecessary expence, along mountainous ridges, which present of themselves sufficiently insurmountable obstacles to an invading army. It is, nevertheless, justly accounted the most enormous fabric in the known world; and it has been computed, that, including the earthen part of the mound, it would furnish materials sufficient to surround the earth, on two of its great circles, with two walls, each of them six feet high and two feet thick. It has been farther calculated, that all the dwelling-houses of Great Britain, supposing them to amount to the number of 1,800,000, and to average 2000 cubic feet of masonry, would not be equivalent to the solid contents of this immense building.

Grand Canal.

Nearly equal to this extensive work in grandeur, and superior in point of utility, is the imperial, or grand canal. The Chinese refer its origin to a much earlier date than that of the great wall; but it does not appear to have existed in its present improved state, and immense extent, above 400 years. When Shee-tsoo, the first emperor of the dynasty of the Mogul Tartars, fixed his residence at Pekin in 1267, and found that the conveyance of supplies to that city, by sea, was attended with innumerable risks and inconveniences; he began the formation of the Yun-ho, or grand canal in 1289, which was afterwards enlarged in 1369 by Tay-tsoo, an emperor of the Chinese dynasty of Ming, and at length united with the river Hoang-ho, and brought to its present state in 1409, by Yong-lo, one of his successors. It traverses the province of Shang-tong, and a part of Kiang-nan, and enters the river Hoang-ho at the city of Yang-kia-yn. It resumes its course at Tsin-kian-poo, passes by Yang-tcheoo-foo, and discharges itself into the Yan-tse-kiang at Koos-tcheoo. It begins, once more, on the other side of the river at Tsin-kiang foo, and continues its progress to the city of Hang-tcheoo-foo, where it completes a tract of more than 300 leagues. It is thus carried from north to south, in such a manner, as to cut at right angles the three great rivers Eu-ho, Hoang-ho, and Yan-tse-kiang, which carry off its superfluous water to the sea, while it receives a sufficient supply from the smaller streams in its course. It is bordered by strong dikes, sometimes cased with stone, but commonly constructed of alternate layers of earth and straw. To accommodate the general level of the canal to the several levels of the feeding streams, it has been necessary, in many places, to cut a channel to the depth of 60 or 70 feet below the surface; and, in other places again, to construct embankments along swamps and lakes to the extent of several miles, and often 20 feet above the level of the surrounding country; so that a sheet of water 200 feet wide, is seen rolling along at the rate of three miles in an hour, on a level often with the tops of the walls of the cities on its banks. The general slope of the country, in the course of the canal, is from north to south; and the middle point is found to lie between the rivers Eu-ho and Hoang-ho. It is chiefly therefore towards the north, that the level is preserved by cutting the channel to a considerable depth; and towards the south, that it is forced above the surface of the country by embankments of earth and stone. In the more hilly and uneven tracts, no locks are employed; but the canal is interrupted by an inclined plane; and the vessels, by means of large capstans, are hoisted up the one side out of the water, and lowered into it on the other. Where the canal is on a level with the surface of the fields through which it flows, small ditches are dug in its banks to let some of the water pass off into the adjacent soil, and bridges are thrown over these openings to preserve the communication. As an additional mean of preserving the level of the water, there are flood gates placed at certain distances, composed of large planks sliding in grooves, which are cut in the sides of stone abutments.

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* See, under the article BRIDGE in this work, an account of some other remarkable Chinese bridges, and the observations of one of our most eminent engineers on the subject of these structures.

Antique ruins. There are no ancient architectural ruins in the Chinese empire; and, except the Great Wall, the Grand Canal, the walls and gates of some of the cities, and a few of the oldest pagodas, it is supposed, that there is not a single building in the whole country, which has existed above three centuries.

Sculpture. The Chinese artists are able to carve very skilfully in wood, ivory, or stone; but they execute the figures of men and animals in the most miserable style imaginable. They have no idea of order, attitude, or proportion; and there can nothing be conceived more monstrous and grotesque, than the figures, which adorn their bridges, temples, and tombs. These even are seldom cut in stone, but are most frequently made of baked clay, covered with varnish, paint, or gold-leaf. The triumphal arches, so highly extolled by the missionaries, are nothing but four-sided blocks of wood or stone, covered with inscriptions, but altogether devoid of any real ornament or grandeur; and it has been affirmed by recent travellers, that there is not a statue, or a column in the whole empire, which deserves to be noticed.

Painting. In painting, the Chinese resemble the Hindoos, Mexicans, and Peruvians, and display extraordinary powers of the most minute imitation, without the smallest portion of scientific knowledge, or of original invention. They will draw the exact number of petals, stamina, thorns, spots, &c. of a flower, and will even count, with the utmost exactness, the scales of a fish; but they faithfully represent every defect, as well as excellence, in the object of their imitation; and have been known to be so very deficient in judgment and information, as to unite, in one figure, the flower, the stalk, and the leaves of different plants. They depict, indeed, with unrivalled exactness and brilliancy, the colour of flowers, birds, and insects; but they are utterly unable to mix and soften their tints, to apply properly the lights and shades, or to convey the smallest idea of distance and perspective. **Perspective.** They even consider the diminished appearance and faded colouring of distant objects, as the consequence of a natural defect in the organ of sight, and look upon it as a most absurd practice to represent such an imperfection upon canvass. They always take a bird's eye view of their landscapes, and place themselves successively in the front of every part, whatever be its position or extent. There is thus no particular point in their paintings, from which the view is taken; and in order to express the distant figures, they represent the appearance of clouds dividing them as it were in two. Their emperor, particularly, must never be represented like another man; and though he should be drawn in the most distant part of a painting, it is necessary that his head be much larger than those of his attendants. They dislike shades, and consider them as defects in European paintings; an instance of which was given by one of their ministers of state, who remarked, upon viewing a portrait of his Britannic majesty, that it was a pity it should have been spoiled by the dirt on the face, meaning the shade of the nose. They catch pretty exactly the features of the human countenance, but execute the colouring very ill. They are still more deficient in the art of proportioning a human figure; and M. De Guignes describes a full length portrait, of an European by a Canton limner, as resembling nothing so much as a sugar-loaf reversed. The specimens of Chinese painting, which are brought to Europe, are pronounced to be the best of their productions, as they are generally executed by Canton artists, who are said to have acquired a superior taste to the rest of their countrymen, by being employed to copy the various European prints and drawings, which are carried thither for the purpose of being fixed upon porcelain vessels. They are all possessed, however, with a sufficient conceit of their pre-eminence in this, as in other arts, over all other nations; and have rejected, with disdain, the plans and proposals of some European artists, to establish schools of painting in their country.

Music. Music would appear, from the Chinese records, to have been always highly esteemed among them; and, in ancient times, to have been employed as an instrument of government, and the handmaid of good morals. No public ceremony was then performed without the aid of music; and the office of prime musician was one of the most important in the state. He was at once physician, moralist, poet, and historian; physician, because he suited his tones to the temperature of the air and the seasons of the year; moralist, because he taught lessons of virtue; poet, because he composed verses, which he accompanied with his music; and historian, because, being employed to celebrate the acts of eminent men, it was necessary, that he should be able to draw from the page of history the most memorable transactions, and such as were most deserving of being transmitted to posterity. The Chinese, like the Greeks and Egyptians, speak of their ancient music, as an instrument of extraordinary power, often producing the most wonderful effects; and as these other nations had their Hermes and their Orpheus, so the country of China boasts of a Lyng-lun, a Pin-moo-kia, and especially a Kuei, who were able, by their skilful sounds, to soften the hearts of men, and to tame the most ferocious animals. The Emperor Shun, according to the Shoo-king, among other important duties of his high station, witnessed the performance of the instituted dances, and caused the approved pieces of music to be duly executed. "When I strike upon my musical stone," said his master musician Kuei, "the most ferocious wild beasts testify their joy; the people and the rulers are of one accord." To this day, every public ceremony has its appropriate air; and nothing is done by the emperor without some musical accompaniment. On the more remarkable occasions, such as the public audiences given by the emperor on his throne, they profess to perform some of the most ancient compositions, called Shao-yo, which were invented in the time of the Emperor Shun; and these are said to be tolerably soft and pleasing airs, not unlike the church music of Europe. But the Chinese themselves speak of their ancient harmony as now lost; and their modern performances, though sufficiently delightful in their ears, are represented by European travellers as wretched and discordant to an extreme. The ancient Chinese had only five tones, Kong, Shang, Keo, Tche, Yu, corresponding to the fa, sol, la, ut, re, of European nations; but under the dynasty of the Tcheoo, they afterwards added two semitones, Pien-kon and Pien-tche, equivalent to our mi and si.* This gamut of five whole notes and two semitones, resembling the natural scale of the Greeks, is marked by appropriate characters, like those of their written language; and by the help of these signs, or names of every note, they are able to write down a piece of music in a very clumsy stile; but they are ignorant of the mode of noting their tunes by means of spaces, lines, marks of the key, time, and expression. Several of these improvements they are said to have learned from the Jesuit missionary Pareira; but they discover no acquaintance with those scientific calculations and geometrical operations for perfecting the scale of notes, which the missionary writers have ascribed to the ancient musicians of China. They wander amidst flats and sharps without any fixed rule; and, in their transitions to a fourth or fifth, they run through all the intervening tones, semitones, and even quarter tones, in the most drawling manner possible. Though their bands occasionally attempt to play in unison, and an instrument among them is sometimes heard taking a higher or lower octave; yet it is affirmed, that they are wholly unable to play in parts, or to blend together several distinct melodies, so as form one concert of harmony. Their music, in short, is said to be altogether inconsistent, and incapable of being reduced to any certain rule; utterly unlike to that of any other existing nation; destitute also of any resemblance to the system of the ancient Greeks and Egyptians; and is either completely original, or a fragment of some style more ancient than any of those which are at present known.

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* On the subject of Chinese music, see *Memoire sur la Musique des Anciens*, par Abbe Rousseau; and *Memoires Nouvelle sur la Chine*, tom. vi. par P. Amiot.

Music in China is neither learned as an accomplishment, nor practised as an amusement, by private individuals; but is the study only of those persons, who hire themselves for the entertainment of others, especially of those females, who are educated for sale, or addicted to prostitution.

Musical instruments.

Their musical instruments are sufficiently various, both as to their form and materials. They distinguish eight different kinds of sounds; and believe, that there are just as many sonorous bodies formed by nature, viz. the sound of skin, of stone, of metal, of baked earth, of silk, of wood, of the bamboo, and of a gourd.

Of the first class are drums, formed of boxes or barrels of baked earth or of wood, covered at both ends with the hide of some animal, generally the buffalo. Some of these drums are of a very large size, and when used, are placed on one end upon the ground, or upon stands resting on three or four feet, according to their size. Father Magalhens speaks of a drum at Pekin, which was forty feet in circumference.

Of the second class are the instruments called King, which consist of a number of sonorous stones of a siliceous nature, cut into the shape of a carpenter's square, and suspended by the angle in a wooden frame. Their tone is rendered flatter by diminishing their thickness, and sharper by taking from their length; and they are played by striking them with a rounded staff.

Of the third class are their bells, which are of various forms; sometimes round, occasionally flattened, and, in the lower part, resembling a crescent. They are composed generally of a mixture of tin and copper, and are sometimes of an enormous size. Father Magalhens describes one at Pekin, (which is used for announcing the hours of the night, and the sound of which is said to have an awfully solemn effect), as 13½ feet in diameter, 42 feet in circumference, 12 feet in height, and 50 tons in weight. Instruments are formed of 16 bells, properly assorted to correspond with the notes of the 16 sonorous stones, of which the King are composed. To this class belong also the different kinds of cymbals, and particularly the Loo or Gong, which is a kind of shallow kettle, with a flat rim raised about three inches, which is composed of a mixed metal of copper, tin, and bismuth, which is struck with a wooden mallet covered with leather, and which yields a shrill and piercing sound, heard at a very great distance.

Of the fourth class is the Hiuen, an instrument which the Chinese regard as of great antiquity, and which is a hollow piece of baked earth, about the size of a hen's or a goose's egg, and furnished with six holes to produce the notes, and a seventh for the mouth of the player.

Of the fifth class are the Shee and Kin, which are also instruments of great antiquity, and which are a species of lyres with strings of silk. The latter has only seven strings, and is generally about five feet in length; while the former is about nine feet long, and is frequently furnished with strings to the number of 25. Upon these instruments they play with the finger or a small stick. There are also different kinds of guitars with two, three, or four strings, which are the favourite instruments of the men; and a kind of violin, with two strings of different tones, between which the bow is made to pass, and the sound of which is described as peculiarly grating to an European ear.

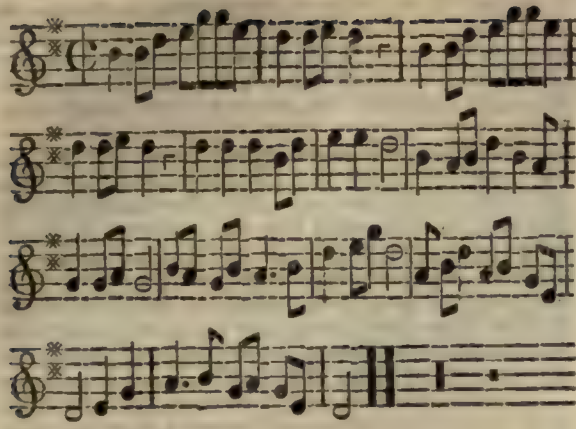
Of the sixth class are the wooden instruments called Tchoo, Yu, and Tchoong-too; the first of which is shaped like a bushel, and is struck with a hammer on the inside; the second is the figure of a tyger in a squatting position, and constructed in such a manner as to emit a sound, when gently scraped on the back with a rod; and the third consists of twelve pieces of wood tied together, which are used for beating time by holding them in the right hand, and striking them against the palm of the left. There are also hollow wooden instruments shaped like a fish, about 2½ feet in length, and six inches in breadth, which are much used by the soldiers in some provinces, and by the bonzes at their devotions, and which are struck with a loaded stick while they rest upon a kind of cushion.

Of the seventh class are the various kinds of flutes and pipes, which are chiefly used by the women; the most common of which has ten holes, and is extremely shrill and piercing. Others may be called trumpets, sometimes without holes, and sometimes with five or eight, and not unlike the French clarionets; the sound of which is exceedingly monotonous and disagreeable to the ears of an European.

Of the eighth class is the Sheng or Sing, one of the most agreeable of the Chinese instruments, which is a species of organ or rather Pan's-pipe, composed of a number of unequal bamboo reeds fixed into the lower half of a gourd, and furnished with a pipe on one side, shaped like the neck of a goose, to which the mouth of the player is applied, and which conveys the air to all the other reeds. The sounds, which it produces, are said to be sufficiently pleasing, but so wild and irregular as to be incapable of being reduced to any scale.

All these musical instruments are exceedingly imperfect, and are managed with very little taste or skill. The excellence of a performance seems to consist, in the opinion of the Chinese, in the greatness of the noise, produced by a confused union of different instruments; and the chief merit of the individual performers, in their musical bands, seems to consist in striking their drums, gongs, and cymbals with the utmost rapidity and vigour.

Their vocal music is more soft and pleasing; but the sounds are often forced through the throat and nose, in a very singular and indescribable manner. Their strain of singing is rather querulous and plaintive, yet seldom expressive of much feeling. There is commonly some accompaniment by a guitar; and the following favourite air of the Moo-lee-wha, from Mr Barrow, may be given as a specimen:—



AGRICULTURE.

Land holders.

Scarcities.

It is the great maxim of the Chinese government, that agriculture is the true source of national prosperity and wealth; and they have, in every period of their history, been forward to bestow the highest honours upon the improvers of this art. The husbandman holds the next rank to men of letters, and the officers of state; and both priests and soldiers are busily employed in the cultivation of the soil. Besides the annual ceremony of the emperor's commencing the labours of the season, at the vernal equinox, the first characters in the empire glory in giving their countenance and aid to the pursuits of husbandry; and, by the honour thus openly and universally testified for the occupations of the labouring classes, a most powerful and permanent impulse is given to their exertions. The emperor is regarded as the sole proprietor of the soil; and the holder of a landed estate pays as rent to the sovereign one-tenth of what his ground is supposed capable of producing. Though he be thus in reality, therefore, a tenant at will, yet he is never deprived of his possession, as long as he continues to pay his rent, or rather land-tax to the crown; and the Chinese cultivators regard their farms in no other light than personal property, as long as they find means to pay the public assessments. These holders of lands from the crown resemble European proprietors in this respect, also, that they can let what portion of their grounds they please, to others, for a rent which is generally equal to half the produce; and it is on these terms, that the great body of the Chinese peasantry cultivate their little farms. There is thus a pretty equal division of the lands among the growers of grain; and there are no immense farmers or monopolizers of produce, who can command the market. There is no ground set apart for the pleasure of individuals, but all is open to cultivation, and a free sale permitted to every dealer. There are no restrictions either from fishing upon the rivers, coasts, and lakes, or from killing game upon their own lands, and the public commons. Yet, with all these encouragements to the agriculturists, and notwithstanding all the honour attached to their occupation, they are not able to supply the wants of the nation; and seldom do three years elapse in succession, without a famine in one or other of the provinces. This frequent recurrence of scarcity may no doubt be partly ascribed to the circumstance of China being surrounded by mountainous and barren countries, from which it can draw no provisions in an unfruitful season, but which it is rather obliged occasionally to supply; to the want of foreign commerce, which prevents the importation of grain in the event of deficiencies; to the destruction frequently occasioned to the crops by droughts or inundations; to the great quantity of grain, especially of rice, which, in spite of the existing laws, is daily employed in the distillation of rack, and other spiritous liquors. But the principal cause of these scarcities is to be sought in the immense tracts of lands, which are suffered to lie waste, and in the want ef enterprize and skill in the Chinese cultivators. It is generally imagined, that every spot of ground in the empire is in a state of regular tillage; and then it is made a matter to be accounted for, how famines should be so very frequent. We read in many of the accounts of China, of the wonderful fertility of its soil; of the care of the husbandman to root out every hedge or tree, so that not a foot of ground may be lost; of the very mountain-sides being cut into terraces, like those of the *Pays de Vaud*, between Lausanne and Vevay, and covered with produce. All this, indeed, is strictly the fact in the immediate neighbourhood of towns and villages; but, partly from the dread of plunderers, and partly from the want of cattle to transport the manure and the produce, the more distant lands are almost entirely useless and unproductive; and it is calculated, that one-fourth of the whole country consists of lakes and swamps, which are totally uncultivated. On each side of the river Pei-ho, at no great distance from the capital, the gentlemen of the British embassy perceived no appearance of great cultivation. The greater part of the land was sour swampy ground, covered with coarse grass, rushes, and reeds; and few trees were to be seen, except in the vicinity of the villages. No habitation appeared, that could be considered as the residence of a gentleman, or even as a comfortable farm-house; but every thing, on the contrary, seemed to indicate the greatest poverty and meanness of condition in the inhabitants. The property of all this waste land is vested in the crown; but any individual, upon giving notice to the proper magistrate, may obtain whatever portion he chooses as a possession, by merely paying into the public granaries the estimated part of the produce, as rent to the government. But, owing to the poverty and ignorance of the yeomanry and peasantry, they can neither bear the expence of breaking up waste lands, nor execute the draining which these wet grounds require. Thus a considerable portion of the richest soil is entirely lost to the community; and the little spots of ground, which each individual husbandman occupies, seldom yields more produce than pays his rent, and supplies his family. The Chinese cultivators, also, though abundantly industrious, are extremely deficient in agricultural skill; and it may be said of them, in general, that they are rather gardeners, than farmers. One of their peasants, indeed, with as much land as he and his family are able to work with the spade, will raise a much greater quantity of food from that spot, than any European could produce; but if 50 or 100 acres of the best soil were assigned to him as a farm, he would scarcely draw from it even the moderate rent required.

Implements of husbandry.

Their instruments of tillage are extremely defective; and their common plough, which is of the most simple construction, dragged by a single buffalo, and far inferior to the worst in England, seldom opens the ground to the depth of four inches, in the best and deepest soils. Thus they never turn up new earth, and, though they were in possession of more effective instruments, their asses and mules would not be able to perform the work. The plough is composed of a single piece of crooked timber, the lower extremity of which is armed with the sock, and the superior is guided by the hand of the husbandman; while a perpendicular piece of wood rises from the middle of the beam, across the top of which another piece is placed lengthwise, one end of which is fixed to the handle, while the other is connected with the traces. The harrows are of different forms, according as the clods are of a greater or smaller size; but the kind, which is commonly used to smooth the surface, is very flat, composed of planks joined closely together, and armed with three rows of teeth. Upon this instrument the labourer places himself, and directs the buffalo which drags it, by a cord attached to a ring passing through the nostrils of the animal.

Mode of cropping

The Chinese farmer never suffers his ground to remain in fallow; and yet frequently raises from it two crops in the season. In the southern provinces, they procure two crops of rice, sowing the second as soon as the first is gathered. Sometimes, after a crop of cotton or indigo, they sow the field with wheat, which is ready to be cut in the months of May or June in the following year. Sometimes, they plant a row of beans between the drills of wheat, which ripen after the wheat is cut down; and their second crops are generally, lentils, beans, sweet potatoes, salads, or yams.

Manure.

The soil, which is generally loose, sandy, free from stones, and easily laboured, requires much manure, which is extremely scarce in the country, as very few domestic animals, and scarcely any sheep or cattle, are reared by the farmer. In the northern provinces, indeed, where horned cattle are more numerous, the husbandman is supplied with dung as in Europe; but, even in these quarters, the cattle are not provisioned in such a manner as to produce much manure. As the Chinese make little use of milk or butter, they are not careful to supply their cows with green food. They do not cultivate any of the artificial grasses; but feed their cattle chiefly on chaff and straw during winter, and in summer upon the rank natural herbage, which grow in the ditches, or on the common reeds, which cover large tracts of swampy grounds in many districts. In this dearth of manure, they make great use of composts, in which the principal ingredient is human ordure. This and other excrements are collected with great care, wherever they can be found. Large earthen jars are sunk in the ground around the houses for collecting urine, and every kind of putrid matter. The old men and children about the villages may be seen going their rounds, with rakes and baskets, gathering filth of every description. The slime and mud is dragged up from the bottom of the rivers and canals, and is particularly applied as manure to the cotton fields. The companies of soldiers and porters, who occasionally stop on their route for necessary purposes, are faithfully attended to their places of retirement by these dung-hunters. The barbers even carry a small bag along with them, to collect the hair, which they shave from the heads and faces of their customers, and which is accounted a very useful manure. Lime, burnt bones, decayed wood, putrid plants, and every similar substance, are carefully collected for the same purpose. All these various excrementitious and putrid matters are thrown into large holes in the fields, lined with cement; reduced almost to a liquid state by the addition of urine or water; and then poured, rather than spread, upon the soil. Manure is even considered as an article of commerce, and is transported in different forms to considerable distances. Boats of a particular construction, and filled with every species of ordure, may be seen passing along the rivers and canals; and their cargoes are sometimes made up in sufficiently curious shapes. "Among the different commodities for the supply of the capital," says Mr Barrow, "we observed an article of commerce that puzzled us not a little to find out for what it was intended. It consisted of dry brown cakes, not much larger but thicker than those we call crumpets. A close examination, however, soon discovered the nature of their composition, which, it seemed, was a mixture of every kind of filth and excrementitious substances, moulded into their present shape, and dried in the sun. In this form, they are carried to the capital, as articles of merchandize, where they meet with a ready market from the gardeners in the vicinity; who, after dissolving them in urine, use them for manure." In order to compensate for this deficiency of manure, the Chinese farmers are incessantly employed in working the soil and mixing it with extraneous matters, such as marl and stiff clay in light sandy grounds, and gravel or sand in strong clayey soils.

Grains cultivated.

The most prevailing crop in China is rice, especially in the southern provinces, and wherever there is a sufficient command of water. Next to rice, barley is most generally cultivated; wheat is very common, particularly in the northern districts; and the other grains are buck-wheat, millet, maize, peas and beans. The principal plants and shrubs cultivated as crops, are the sugar-cane, cotton, hemp, lint, tobacco, indigo, the tea-tree, the mulberry-tree, the varnish-tree, the camphor-tree, the tallow-tree, the cinnamon-tree, &c. In the fields also are cultivated a variety of pot-herbs, particularly a plant called pe-tsai, which is a species of beet, carrots, which are remarkably large, radishes, turnips, mustard, earthen pistachios, yams, and sweet potatoes.

Season and manner of sowing.

The first crop of rice is generally sown in March, and the second in July, according to the rains. The rice, before being sown, is steeped in pure water; the other grains in lime-water or urine, and this last is said to have the effect of preserving the seed, especially that of turnip, from insects. In the month of February, according to the observations of M. De Guignes, the crops were appearing above ground. In March and April, the barley was well advanced, the sugar-cane a foot above the surface, the oil shrubs in flower and beginning to ripen, and the hemp above a foot and a half in height; but the tallow and mulberry trees, at the same period, were scarcely in leaf.

In small patches of ground near the houses, where they study great neatness, the grain is often planted by dibbling; generally however by drilling, as a more expeditious method; and rarely by broad cast, which is neither so saving of the seed, nor so well suited for the clearing away of weeds. In sowing rice, they sometimes prepare a portion of ground as a seed-bed, which they cover with the grain in the broad-cast manner of sowing, and, when the plants have risen to the height of six or seven inches, they transplant them in rows into a field, which has been well levelled and watered. According to another method, the soil is well prepared and moistened, and the rice planted by the dibble in holes at the distance of six or seven inches from each other, into each of which several grains are put; but this plan requires a better soil, and consumes a greater quantity of seed. Sometimes, wheat is planted in the same manner. In some of the northern provinces, a sowing machine is used in the lighter soils, which is guided by two labourers, and which opens the drill and drops the seed at the same time. Great care is used to clean the crops of rice from weeds, and to supply them with water; and sometimes they sprinkle powdered lime over the plants, to destroy the vermin, and to render them more productive.

The stalks of the rice, wheat, and barley, seldom

Agriculture.

Harvest and produce.

grow to a greater height than three feet; but the straw of millet is commonly about five feet in length. The crops, in the middle provinces, are generally ripe in the beginning of June, and in the southern districts, are sometimes cut in April or May. The rice is ordinarily reaped three months after being planted; and its produce is generally from twenty-five to thirty for one, while that of the other grains is commonly from ten to fifteen for one. The corns, when reaped, are put up in small ricks, till they can be conveniently thrashed; but sometimes, especially in the northern provinces, where the sky is remarkably free from clouds in the autumn season, the grain is thrashed in the fields as soon as it is cut. This is done by beating the ear against the edge of a plank, or by treading it with oxen and buffaloes, or by passing over it cylinders of stone, or by flails in the hand as in Europe. The part of the flail which strikes the grain is sometimes composed of two pieces of wood; and is fixed to the handle, not by a piece of leather or skin, so as to turn easily any way, but by a small peg, which allows it to move only in a vertical direction. Besides the rice of a white colour, there is an inferior kind, of a reddish hue, which is eaten by the lower classes, or employed in distillation. The Chinese never cultivate oats, which would grow well in their fields, but which they pull up as a useless plant. Their horses are fed with cut straw and beans, or with natural grass. Their draught cattle are oxen, buffaloes, asses, and mules; but all these are, every where, except in the northern provinces, extremely rare; and no means are used for improving the breed of any domestic animal.

Gardening.

The Chinese excel in gardening, more than in agriculture; and have the talent of rendering a small spot productive in the highest degree. They confine their attention, however, principally to the quantity of vegetable produce, and are little acquainted with the means of improving the quality of their fruits, and hastening the growth of plants by the exclusion of cold air, by the admission of the sun's rays through glass covers, or by the application of artificial heat. Their oranges, and other native fruits, are naturally good, without much attention on the part of the gardener; but the European fruits raised in the country, namely, apples, pears, peaches, apricots and plums, are very indifferent. Their method of propagating fruit trees is curious, and may be worthy of notice. In the spring season, they strip a ring of bark, about an inch wide, from a bearing branch; surround the place with a ball of fat earth or loam, binding it fast with a piece of matting; and suspend directly above it a pot or horn full of water, with a small hole in its lower part, sufficient to let the water drop in such quantities, as to keep the earth constantly and uniformly moist. The branch, when treated in this manner, throws out new roots into the ball of earth just above the ring, from which the bark was taken; and, if sawn off and planted at the fall of the leaf, it bears fruit the following summer.

Method of propagating fruit trees.

Embellishments of gardens.

The Chinese are particularly eminent in the art of embellishing garden grounds, which may be considered as the only one of the fine arts, in which they display either genius or taste. In this department, they are said to have attained a high degree of perfection; and to possess the most striking and distinct conceptions of picturesque beauty. There is supposed to be a great resemblance between the English and the Chinese style of gardening; except, that the excellence of the former consists rather in improving, and that of the latter in conquering nature. The object of a Chinese planner is to change every thing from the state in which he finds it; and he is therefore little anxious about the natural advantages of the spot, which he chooses as the scene of his operations. "If there be a waste," says Lord Macartney, "he adorns it with trees; if a dry desert, he waters it with a river, or floats it with a lake. If there be a small flat, he varies it with all possible conversions; he undulates the surface, he raises it with hills, he scoops it into vallies, he roughens it with rocks." They require only a good exposure, a salubrious atmosphere, and a retired situation; and then they set themselves to collect, in that one spot, all the most interesting and picturesque objects, which an extensive tract of country could furnish. Their great object is to bring together under one view the cultivated field and the barren waste, and they particularly exert themselves to render the surface uneven; to cover it with factitious rocks, to dig caverns and narrow passages along the sides of the eminences; to cover some of these little hills with wood, and to leave others completely naked; to plant their trees in the utmost irregularity, as if dropped by chance, and to open, amidst all this apparent disorder, a number of winding paths, which perpetually approach each other, without even uniting, and which seem to prolong the extent of the scene, without any termination. If water can be procured, it is precipitated from the heights, made to open for itself a passage among the rocks, conducted through the grounds in various directions, and at length collected in a lake, upon which the ladies, in barks of an elegant construction, amuse themselves with sailing, fishing, and enjoying the freshness of the fragrant air. These lakes are covered with leaves and flowers of their large and beautiful water plants; stored with a multitude of little shining fishes; studded with islands, ornamented with pavilions, triumphal arches and pagodas; and bordered with rugged stones, which communicate a romantic irregularity to their form and aspect, or with a shade of weeping willows hanging over a beach of shells and sand. The general defect of these scenes is the confusion, created by such a multitude of different objects, crowded within a narrow space; and one instance of bad taste, from which none of them is exempt, appears in the large porcelain figures of lions, tygers, &c. which are scattered about in the greatest profusion.

Imperial gardens.

The most magnificent and extensive of the emperor's gardens are those of Yuen-min yuen at Pekin, and of Gehol in Tartary; the latter of which is admirably described by Lord Macartney,* who compares the western part of it to Lowther hall in Westmoreland. The former comprehends an extent of ground, not less than ten English miles in diameter, or about 60,000 acres; and contains, within its inclosure, thirty separate habitations for the emperor, each of them composing a village of considerable magnitude. Much of it is waste or woodland; and the general aspect of some parts of it is likened to that of Richmond. The trees, in some places, are so carefully arranged with respect to their figure and foliage, as to present a most beautiful landscape; while its numerous canals, rivers and lakes, are disposed in so irregular a style, as to have more the appearance of a natural origin, than of an artificial construction.

POPULATION.

The population of China has been a subject of much calculation and of keen dispute among all who have written upon the state of that empire; and there are still no sufficiently authentic documents, from which its amount can be satisfactorily ascertained. The statements of the French missionaries refer to so many different periods, are founded so much upon mere conjectural computations, and are attended with so many irreconcileable discrepancies, that it is impossible to frame a consistent view of the matter from the varying data, which they severally furnish. The inhabitants of China, for instance, have been calculated

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* Barrow's *Travels in China*, p. 126.

In 1122	at	46.734,784
In 1290	at	58.834,711
In 1650	at	105.871,434
In 1662	at	115,052,724
In 1736	at	117.967,745
In 1743	at	150,265,475
In 1760	at	196,837,977
In 1761	at	198,214.553
In 1794	at	333,000,000*

The following table presents three of these statements in a more detailed form; and may enable our readers, by a comparative view of their variations, to detect more easily, and to ascertain more clearly, their complete inconsistency. The statement for the year 1743, is founded upon the report of the French missionaries; that for 1761, upon the authority chiefly of Father Allerstain; and that for 1794, upon the accounts of the British embassy.

Provinces.	1743.	1761.	1794.
Pe-tchelee .	16,702,765	15,222,940	38.000,000
Kiang-nan .	26,766,365	45,922,420	32,000,000
Kiang-see .	6,681,350	11,006,640	19,000,000
Tche-kiang	15,628,990	15,429,690	21,000,000
Fo-kien . .	7,643,035	8,063,671	15,000,000
Hoo-quang	4,264,850	16,909,923	27,000,000
Ho-nan . .	12,637,280	16,332,507	25,000,000
Shan-tong .	12,159,680	25,180,734	24,000,000
Shan-see . .	8,969,475	9,768,189	27,000,000
Shen-see . .	14,804,035	14.699,475	30,000,000
Se-tchuen .	15,181,710	2,782,976	27,000,000
Quang-tong	6,006,600	6,797,597	21,000,000
Quan-see .	1,143,450	3,947,414	10,000,000
Yun-nan . .	1,189,825	2,078,802	8,000,000
Koei-tchoo .	255,445	3,402,722	9,000,000
Leao-tong .	235,620	668,852	10,000,000
	150,265,475	198,214,552	343,000,000

The last of these statements, which makes the population of China amount to 333,000,000, omitting Leao-tong, was communicated to the British embassy by the principal Chinese officers of state; and Mr Barrow, though ready to acknowledge the little dependence which can be placed upon their authority, endeavours, with considerable ingenuity, to prove at least the possibility of its truth. If China contains 1,297,999 square miles, there would thus, upon an average, be 256 souls to every square mile, which is not much more than twice the proportion which is found to exist in Great Britain. The united provinces of Holland have been calculated to contain 270 inhabitants upon every square mile; and the island of Barbadoes, which is said to have contained, in 1670, a proportion of 500, is ascertained, by a more accurate enumeration in 1786, to support at least 263 inhabitants upon each square mile. Hence it is argued, that China may be conceived, without any great stretch of belief, to maintain the number assigned above, especially when it is considered, that it enjoys advantages favourable to population beyond most other countries in the world. In support of this opinion, it is alleged, that, excepting a few skirmishes on the frontiers with the Russians and Indians, it has enjoyed a profound peace since the Tartar conquest; that, as its soldiers are parcelled out as guards in the towns, cities, villages, and stations upon the roads and canals, where they have portions of land allotted for their use, they all enter into the married state; that, as the nation has little foreign commerce, there are few seamen in proportion, and that those who belong to the inland navigation are generally the fathers of families; that celibacy is, by public opinion, regarded as discreditable, and, after a certain time of life, is actually marked with infamy; that every male child may secure a subsistence from the moment of its birth, by being enrolled in the military list; that there are few of those large manufactures and mechanical occupations in crowded cities, which, in other countries, prove so destructive to health and population, by the debaucheries and diseases which they occasion; that, by the equal division of the soil into small farms, every peasant possesses the means of bringing up his family, while the great body of the people are also, from the same cause, employed in active and wholesome labour in the open air; that the lower orders, partly from their poverty, are temperate in their mode of living, and little addicted to the vice of drunkenness; that the climate is moderate and uniform, and that, excepting the small-pox and other contagious disorders, which occasionally break out in their more confined and crowded cities, there are few epidemical distempers in the country; that no superfluous animals are kept for pleasure, and even very few for labour, so that the whole cultivated surface is applied almost solely to the production of food for human beings; that the people abstain almost entirely from animal food, except those kinds which are most easily reared, such as pigs and poultry, and live almost wholly upon grain, viz. rice, which yields an immense increase, and of which they can often raise two crops in the year; that the carriage of goods from place to place is performed, not by unproductive highways, but by canals, rivers, and lakes, abounding in fish, and thus affording subsistence to a considerable portion of the natives.† From all these considerations it is conceived, that the population of China may not only amount to the highest statement which has yet been given, but that it is even scarcely equal to the means of subsistence which the country is capable of yielding; and that, were a more efficient plan of cultivation introduced, especially if the more sure crops of potatoes in the northern parts, and of Guinea corn in the south, were substituted for the precarious culture of rice, a still greater quantity of nourishment might be produced, and a still greater number of inhabitants supported.

Causes of its immense population.

Objections to his statement.

On the other hand, M. De Guignes, a more recent traveller in China, and who resided a much longer pe-

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* One very obvious remark, upon these accounts, is this, that if they are founded in truth, then the empire of China, instead of having continued nearly in its present state of civilization and prosperity, for the space of 2000 years, appears rather like a newly established country, increasing rapidly in wealth and population.

† In one day, the British embassy passed, upon the river Pei-ho, more than 600 large vessels, having each a range of ten or twelve distinct apartments built upon their decks, and each apartment containing a whole family; so that each vessel was calculated to lodge about fifty individuals; and reckoning the other kinds of craft passing and repassing, or chained to the banks, and crowded with women and children, they calculated, that, in a space of ninety miles, there were floating on this small branch not fewer than 100,000 souls.

Population.

Population.

riod in the country, decidedly controverts the fact of an immense population in the Chinese empire; and maintains, upon very positive grounds, that it does not much exceed that of other countries, in proportion to the extent of territory.

In this view, he considers, first of all, the presumptive arguments against so immense a population, from the present state of China in respect of cultivation; from the fact of one-third (Mr Barrow himself admits one-fourth) of the soil being altogether unproductive, a point which he fully establishes from the accounts of those missionaries who had traversed the different provinces; from the peculiarity of its situation with regard to the adjoining countries, which are utterly unable to afford any supplies of provisions; and from the frequent failures in its actual produce, and the famines consequent upon such calamities, which have been uniformly presenting the most effectual checks to an increase of population. Thus defective in its own cultivation, and thus unable to procure supplies from other countries, it cannot be presumed to subsist a proportionable number of inhabitants with such nations as Great Britain and the United Provinces, which, in addition to their improved agriculture, import so abundantly from the most distant parts of the globe.

He next examines the statements of Chinese population as actually given, and remarks upon the internal evidence, which they afford, of inaccuracy and uncertainty. In the first period of eighteen years, from 1743 to 1761, according to the preceding table, the province of Pe-tchelee declined in the number of its inhabitants, while, in the next thirty-three years, from 1761 to 1794, it was more than doubled. In the first period, on the contrary, Kiang-nan nearly doubled its population, while, in the second, it declined more than one-fourth. Hoo-quang, in the first eighteen years, increased almost fourfold; while Se-tchuen, in the same period, sunk from fifteen millions to two, and, in the next thirty-three years, rose from two to twenty-seven millions. Koei-tcheoo again, in eighteen years, increased to thirteen times its number; and Leao-tong, in thirty-three years, nearly fifteen times. The very assertion of such progress in a country, which is acknowledged to have been stationary, in point of improvement, for many hundreds of years, is itself a circumstance sufficiently suspicious. In the statement given to the British embassy, the uniform use of round numbers is considered as a sufficient evidence of its inaccuracy, and of its having been founded rather upon conjecture than any actual survey; while it bears other notorious marks of incorrectness and exaggeration. The province of Pe-tchelee, for instance, is represented as more populous than that of Kiang-nan, though it is one-half less in point of extent, and neither so fertile in its soil, nor so full of manufactures. Kiang-nan again, which contains about 10,000 square leagues, is rated at a population nearly one-third, according to the statement of the British embassy, and nearly one-half, according to Father Allerstain's account, greater than that of France before the revolution, a country three times more extensive in point of territory. Such amazing variations cannot be accounted for by the supposition of migrations among the natives from one province to another; as it is known, that, from the poverty, superstitions, and agricultural occupations of the Chinese, there is no nation in the world less apt to remove from place to place. The great diminutions in the population of the different provinces, may easily, indeed, be conceived to have been occasioned by those dreadful famines, which not unfrequently occur in this extensive empire, and which often reduce the inhabitants of a district, to one-half their number; but nothing, in the condition and customs of the Chinese, can explain those speedy and extraordinary augmentations, which the above statements bear.

It is admitted on all hands, even by those who are inclined to credit the highest accounts of the population of China, that no dependence can be placed upon the statements of the Chinese themselves, whose government, says Mr Barrow, "is much given to exaggeration in all matters relating to the aggrandisement of their country, and to deal liberally in hyperboles when numbers are concerned." "No people in the world," says M. De Guignes, "are more disposed to exaggerate every circumstance relating to their own country. They make no scruple whatever to deceive a foreigner, as it gratifies their vanity, and increases their own importance, to overrate the power of their nation." Full credit cannot be given even to those statements, which are drawn from the official papers and most authentic documents of the government itself; because it is the interest of the mandarins to represent the population as always increasing, that the provinces may appear to have improved under their administration; while it would displease the sovereign, and obstruct their own advancement, were they to announce the smallest diminution. Now, as these viceroys are changed every two or three years, and as every one has an equal interest in making these flattering representations, it may easily be conceived how rapidly the population of the empire increases upon the face of the state papers.

It is chiefly, then, from the observations of those who have travelled in the country, that any reasonable opinion can be formed respecting, at least, the relative population of China. There, indeed, also, the accounts are rather discordant; but the majority of recent testimonies decidedly tend to prove, that this boasted empire is not more populous, than other civilized or established countries. Mr Barrow speaks in general, in the most positive terms, of the great population of the different places, through which the British embassy were made to pass; and he insists, that the immense crowds of people, whom they witnessed, were not confined to the larger towns, and the places at which they halted in their progress; but that some of those parts, which were at a distance from the common road, were found to be the most populous of any in their route. This assertion seems to be completely neutralized by his own testimony, in another part of his work, where he expressly says, "the proximity of the capital would have led one to expect a corresponding population. Nothing of this kind appeared. The vast numbers we had observed in ascending the river, were drawn from the distance of many miles out of mere curiosity. The inhabitants only of the vicinity now shewed themselves, and we were rather surprised at the fewness of these, as well as at the very ruinous and miserable condition of almost all the cottages." By the journal of a gentleman in the train of the Dutch embassy, which is cited in the travels of Mr Barrow, we learn, that they were surprised to find so few cities, towns, and villages in their route; that sometimes not a single dwelling, or trace of cultivation, was seen in a space of eight or ten English miles; that many of the habitations, which they did perceive, were in the most ruinous condition imaginable, and that one of the party declared, he did not believe the whole world could furnish such a picture of desolation and misery, as they witnessed.

M. De Guignes enters more fully into the subject, and describes the appearance of the country, in the express view of fixing the degree of the population. We consider his opinion as decisive on this point; and submit to our readers the following extract from his work. "In our route to Pekin, as we ascended the river from Canton to Nan-hiong foo, the last city of the province, in the whole of this space, which is 105 leagues, we found only five cities, distant from each other 17, 19, 24, and 28 leagues. The population in the country was extremely moderate. It appeared to us a little more crowded in the towns. But the circumstance of our passing had collected a multitude upon the route; and when, upon our return, we visited the same places at our leisure, the inhabitants did not appear in greater numbers than in other quarters.

"The same was the case in Kiang-see. Except in two or three cities, to which our arrival had attracted the inhabitants of the surrounding country, the number of individuals was no way surprising. In traversing by water the greater part of this province, we found the cities at the distance of 12, 15, and 25 leagues, and afterwards of 11, 9, and 7 leagues from each other. There was only one at five, and another at three leagues interval. In short, we saw only twelve cities in a space of 116 leagues. When we quitted our barks, and travelled by land in Kiang-see and Hoo-kooang, in an interval of 40 leagues, we passed through four cities; and, as the route lay through the midst of fields, villages, and towns, it would have been easy for us to have satisfied ourselves, whether the inhabitants were very numerous; but nothing presented any proof of such a fact.

"In Kiang-nan, within the space of 118 leagues, we found only eight cities, at a distance from each other of 11, 12, 14, 18, and 21 leagues; and two of them at an interval of 5 and 4 leagues. With respect to this western part of Kiang-nan, there cannot be a moment's doubt respecting the degree of population: it is very moderate.

"Shan-tong presented us successively, in a space of 80 leagues, only with 10 cities, at distances of 22, 11, 9, 8, 6, and 5½ leagues.

"In Pe-tchelee, we found as many, a little nearer to each other, indeed, as we travelled only 63 leagues; but such cities! and above all, such villages! The greater part presented the afflicting spectacle of absolute devastation, while Pekin, in the midst of so many miserable objects, surrounded with vast walls, adorned with superb pavilions and magnificent palaces, seemed, if the expression may be allowed, to have sucked up and absorbed in itself the whole surrounding country.

"Upon leaving the capital upon our return, we pursued the same route as far as the city of Te-tcheoo, where we altered our course, in order to follow the eastern coast. In this new tract, we travelled 83 leagues in Shan-tong, and passed 8 cities, of which the three first, which were nearest to Pe-tchelee, were at the distance of 3 and of 4 leagues from each other; and the rest at a distance of 13, 14, 18, and 20 leagues, and only one at an interval of 7 leagues. The soil in this part of Shan-tong is not so bad as in the western part of the same province, and presented a more numerous, but still not a very crowded population."

"Having arrived at the eastern part of Kiang-see, the best portion of China, and which is always shewn by the Chinese to foreigners in preference to any other part, we found, in the vicinity of the dike which is raised along the banks of the Yellow river, towns which appeared to us extremely populous. It was from this population, that the English formed their opinion; and it was thus that they were led into an error. In passing through the same places as these travellers, I could have believed with them, that the number of inhabitants was considerable; but I discovered, that I would have been deceived, had I trusted to the first appearance. The advantage which we enjoyed of setting out at our own pleasure, afforded us the means of proving, that this population did not wholly belong to the places where we halted, but that a great proportion had been attracted thither from the neighbouring country. These towns, so populous at our arrival, presented almost a complete desert at the time when we took our departure; and we perceived, in the country, numerous bands of the inhabitants, who were returning to their villages.

"Though the part of Kiang-nan, which lies to the north of Hoang-ho, is good, yet in the space of 40 leagues we saw only two cities, at a distance of 24 and 15 leagues; and then three more, after having crossed that river, before coming to Tain-kiang-foo, on the north of the Kiang, that is to say, in a course of 28 leagues. The portion of Kiang-nan, after crossing the river Kiang, is beautiful and well peopled; the towns are closer to each other; and, in a space of 42 leagues, we found five cities at the distance of 4, 5, 7, 8, and 9 leagues from each other.

"Entering the province of Tche-kiang, we passed over 22 leagues without seeing one city; but, as the canals take a winding direction, we left upon one side a city of the first class, and another of the third; but still, reckoning these two cities, we only passed twelve in the 95 leagues which we travelled in this province, that is to say, one city at the distance of 4 leagues, two at 5, two at 7, one at 8, one at 9, two at 10, two at 11, and one at 12. The cantons of Tche-kiang, which border upon the province of Kiang-nan, and those which surround the city of Hang-tcheoo-foo, are well peopled; but, in ascending the river as far as the extremity of the province, the population is moderate, and the cities have nothing extraordinary, although, of the eight cities which we saw in this part of Tche-kiang, and which are at the distance of 11, 10, 9, 8, 7, and 4 leagues from each other, there are two of the first rank.

"We met few people on the road, which separates Tche-kiang from Kiang-see. Yu-shan-hien, the first city of this latter province, and which we had full time to examine, had only a population proportioned to its small extent. In descending the river to Nan-tchang-foo, the capital of Kiang-see, which was a route of 74 leagues, we passed by six cities, of which two were situated at a distance of 8 leagues, one at 10, one at 12, one at 16, and Nan-tchang-foo at 20. This capital where we halted is large, but its population did not appear to us extraordinary. We have thus had an opportunity, during a journey of near 1600 leagues, of judging whether the provinces of China were as populous as the English have advanced. I have made, in going to Pekin, pretty long journies without meeting a single person; and if, in my return, I saw a great number of people in certain places, still there was nothing to excite astonishment. In a word, nothing can induce me to believe, that the population in general is immense. I shall say only one word more. It is an error to suppose, that there exists in China a second population upon the rivers. Except the principal and commercial cities, in the neighbourhood of which a pretty large number of boats are found, there is only seen upon the rivers such a number of people as is suitable to a vast and extended country, the whole of whose commerce is carried on by water." *

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* *Voyages a Pekin, &c.* par M. De Guignes, tom. iii. p. 80.

This author is decidedly of opinion, that the population of China cannot reasonably be estimated higher than 150,000,000; and that even this number is considerably above the truth, as it makes that country in proportion to its extent rather more populous than France, while this latter kingdom contains a greater proportion of cultivated soil.*

NAVIGATION.

Canals.

The inland navigation of China is inconceivably extensive; and in the construction and management of vessels for this purpose the Chinese have reached a very high degree of skill. The whole country is intersected by an infinite number of rivers and canals; which last have been multiplied to the utmost possible degree, not only with a view to water the fields, but also to open communications between different places, and to facilitate the conveyance of goods. The whole of the home trade is carried on by water; and even individuals, travelling from one town or province to another, uniformly, if possible, prefer the conveyance by boats to land carriages. In that way they can travel from Canton to Pekin without interruption, except one day's journey across the tract of land which separates Nan-hiong-foo from Nan-ngan-foo. After leaving this last mentioned city, the course leads down the river to the lake Po-yang, thence along the river Yang-tse-kiang to Kooa-tcheoo, beyond Nan-kin, where the imperial canal commences, and conducts the traveller all the way to Pekin.†

Canal boats.

To the construction of proper vessels for this inland conveyance of passengers and articles of traffic, the Chinese have directed their chief attention; and they are generally allowed to have succeeded beyond all other people, in the great variety and skilful adaptation of their boats to the different purposes for which they are employed, and the different courses of water through which they must pass. Many of them are remarkable for the stateliness and elegance of their form; and especially for the excellent accommodation, which they contain for the passengers who are on board.

Pleasure boats.

The most beautiful of these boats are those, which are intended for parties of pleasure upon the water, and which are generally of a considerable size, containing a small anti chamber, a large apartment in the middle, and a small cabin behind, all neatly furnished and provided with windows adorned with shell-work or lattices. These, and most of the other larger barks, have a projecting gang way of broad planks on each side, by which the crew can pass from one end to the other in working the vessel, without incommoding those who are on board. In calm weather, and when the wind or current is contrary, the vessels are dragged by a rope, or impelled by means of two large bamboo oars, turning upon pivots placed upon projecting pieces of wood, sometimes at the stern, as is usual with most other nations, but often also near to the bow of the vessel. From six to ten men are required to work one of these oars, which they move backwards and forwards in the water under the surface, similar to the English mode of *sailing*, and which they keep very near to the sides of the boat, so as not to interfere with other vessels, as they pass each other in the canals and rivers.

Boats for merchandize.

The boats, which are employed for transporting merchandize, are almost as much rounded above as below, and are covered partly with planks, partly with mats, which can be drawn aside at pleasure in loading and unloading. These barks are heavy and slow, and carry a very large sail; but do not sustain the wind well, unless when they are loaded. One of these vessels belonging to the revenue department, as measured by Mr Barrow, was 115 feet in length, 15 in breadth, and six deep; the sides straight, the width nearly the same fore and aft, and the whole shaped like a narrow trough.

Passage boats.

Next to these, the most numerous kind of vessels upon the rivers and canals are the yachts or passage boats, which are very lightly and neatly built, and are sometimes of a very considerable size, with high upper works, so as to resemble floating houses. Those of the larger class generally contain three apartments for the accommodation of passengers, an anti chamber for the servants and baggage, a commodious sitting or dining-room, about 15 feet square, and a space containing three or four sleeping-rooms. Behind these are the kitchen, and a set of small holes for the seamen. Sometimes there is a kind of second story, divided into little cells like coffins, in which a Chinese sailor, whose whole property is commonly upon his back, accommodates himself with great ease; while on each side is a projecting gang-way, as above described. These vessels are long, narrow, flat-bottomed, sometimes a little curved, and seldom draw above 15 inches water. In one place, the British embassy were conveyed in boats of this description, which were from 50 to 70 feet in length, moderately loaded; and which, nevertheless, did not draw above six inches water. In this way they sailed along a mere trout-stream; in the more shallow places of which a channel was made for the boats by removing the gravel with iron rakes.

Boats for mandarins.

The boats for the mandarins are not unlike the pleasure-boats, generally painted red, ornamented with figures of dragons and little flags.

The Chinese make use also of large rafts of bamboo for conveying wood and rice, and generally keep them on a level with the surface of the water.

Shipping.

In the navigation of the open sea, and in the construction of vessels for distant voyages, the Chinese are as awkward and unskilful, as they are ingenious and expert in the direction of the fresh water shipping.

Maritime intercourse.

It has been asserted, that their maritime knowledge was more extensive in ancient than it is in modern times; that, in the seventh century, they carried on a trade with the western coast of North America; and that at one period, they maintained a commercial intercourse with Bussora, Siraff, and other ports in the Persian Gulf. It is certain, that about the seventh century, they were acquainted with the promontory of Kamskatka by the name of Ta-shan; and it is considered as unquestionable, that the island of Tchoka in the Tartarian sea, opposite to the mouth of the Amour, has been peopled from China. They are supposed also to have colonized Sumatra, as there is a striking resemblance, in person and manners, between the inhabitants of that island and the natives of China; and the Cingalese are considered as still more decidedly descended from a Chinese stock. According to the accounts of the celebrated Italian traveller, Marco Polo, the Chinese must have been in the habit of visiting the island of Madagascar before his time; and it is asserted by Mr Barrow, as an obvious matter of fact, that many of the Hottentots strikingly resemble the Chinese in the form of their persons, in the features of their countenance, and in their manner of speaking, so as to render it highly probable, that those tribes on the narrow extremity of Africa, who differ so remarkably from all their neighbours, have derived their origin from a colony of Chinese, to whom they bear so close a resemblance. Even admitting, however, these marks of affinity between the natives of these different countries and the inhabitants of China, and the probable conclusion that they must have therefore derived their origin from some Chinese colony, there is still no proof of the existence of a regular and extended navigation from China to these quarters. On the contrary, it is affirmed as an acknowledged fact, that the Chinese mariners were not acquainted with the island of Formosa till the year 1430; nor with the isles of Pong-hoo till 1564; and hence it is not at all probable, that they should have been in the practice of frequenting distant coasts at a period when they had not explored the seas which wash their own shores.

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* In the newspaper of the *Pilot*, for August 11, 1812, it is affirmed, that, according to a statistical survey, officially published and recorded in the Gazette of Pekin, (but where or by whom this document has been seen, we have not been able to discover,) the population of the Chinese empire is only about 55,000,000 of souls, which is far below the most moderate of the more recent computations. Perhaps, however, as is generally the case in the Chinese surveys, this number includes only those who are taxable; and multiplying it by 3, which M. De Guignes considers as the fair average of the number in each family in China, the result would be 165,000,000, which is not very different from the highest estimate, which this traveller allows to be at all founded on probable grounds.

† See this Canal described under the head of Architecture and Public Works.

Practical navigation.

Mariner's compass.

Their whole style of seamanship argues no established skill or extended practice. They have no idea of keeping any reckoning at sea, so as to ascertain by estimation of the distance sailed, or by observation of the heavenly bodies, the longitude and latitude of particular places. Their system is to keep as near to the shore as possible, and never to lose sight of land. In this way the commerce of the Yellow sea is carried on from port to port; and the articles of traffic pass through a multitude of hands, before they reach the consumer. When they do attempt more distant voyages to Japan, Batavia, Manilla, Cochinchina, and Borneo, they embrace a favourable monsoon; and if they know the direction of the port which they wish to make, they endeavour, whatever be the wind, always to keep the prow of the vessel pointing as exactly as possible to that particular quarter. They are generally admitted to have been acquainted with the polar direction of the load-stone, and to have employed it in navigation long before that important invention was known in Europe; and it is conjectured, that Marco Polo brought from China, about the end of the thirteenth century, this new and valuable use of the magnetic needle. But, however remote their acquaintance with this discovery may have been, and in whatever way they attained the knowledge of it, they have made little progress in its improvement; and their mariner's compass is to this day an extremely imperfect instrument. The needle is exceedingly diminutive in size, seldom above three-fourths of an inch in length, and so very fine, as well as short, that it does not require to be loaded at one end more than another to prevent its dipping towards the horizon. The card is divided into eight principal points, and each of these again is subdivided into three; while the needle is allowed to traverse the fixed points, instead of being attached to the card. They are utterly ignorant of the variation and inclination of the needle; and the box, in which it is placed, is extremely small, just sufficient to allow its vibration. The margin, however, of this box is frequently so large as to contain 20 or 30 concentric circles, marked with various characters, comprising an abstract of their astronomical science, especially the names of the 12 hours of the day, the 28 signs of the zodiac, the 24 subdivisions or seasons of the year, the cycle of 60 years, the names of certain constellations, with their positions in the heavens, the marks of the five elements, and the rules for calculating lucky and unlucky days. Behind the compass, is generally placed a small shrine or pagoda, with an altar before it, on which a spiral taper of wax, tallow, or sandal wood dust is kept continually burning. This seems to be intended both as an act of devotion and a measure of time; for this taper is divided into 12 equal parts, and proportioned in such a manner, that the whole is consumed in a complete day. It would appear also, that they regard the magnetic needle as a species of divinity, or at least as under the protection of some superior being; as, upon every appearance of a change of weather, they burn incense before the compass. The box, which contains it, is not suspended, but generally placed in a vessel full of sand; in which, when they have no shrine, are stuck little candles of scented wood, or merely slips of bamboo, with a little sandal wood dust on one end.

Trading vessels.

Masts.

Sails.

Rudder.

Anchors.

The construction of their trading vessels, intended for distant seas, is extremely unfavourable; and it is considered as a matter of wonder, how they are able, even with the aid of the compass, to reach the ports of Batavia in such clumsy and unmanageable shipping. These merchantmen are called by the Portuguese, Soma or Sommes; and by the Chinese, Tchuan, which last appellation the British seamen have corrupted into Junks. The general form of the hull, or body of the ship, as seen above water, is like the appearance of the moon, when four days old, as the two extremities rise to a great height above the deck. The bow or forepart is not rounded, as in the vessels of Europe, but square and flat, like the stern, without any of the projecting wood called cut-water, or any kind of keel. In the front is frequently carved the open mouth of a dragon; but on each side of the bow, is generally painted also a large circular eye, supposed to be an imitation of that of a fish. There is no bow-sprit; but there are two, three, and often four masts, each of which consists of a single piece of wood, incapable of being reduced in length, not less in diameter, in the larger traders, than those of a British 64; and fixed in beds of massive tin, laid across the deck. Each mast has a single sail of bamboo matting, stretched by means of bamboo poles, running across at the distance of two feet from each other; and constructed in such a manner, that the sail can be folded together like a screen, or furled like a fan. These sails are extremely heavy, and difficult to be extended or lowered; and in the former operation, a kind of machinery is frequently employed; and, in the latter, a sailor ascends the mast, and pushes down the sail with his feet. Hence, the Chinese seamen are very reluctant to lower their sails, even when the safety of the ship requires that precaution; and many of their vessels are upset by the mere quantity of sail which they keep up in blowing weather. When these large sails are hoisted, and braced almost parallel with the sides of the ship, a Chinese junk will run within four and three points, or even sometimes half a point of the wind; but this advantage is greatly counteracted by their want of keel and their rounded bottom, which cause them to drift much to leeward. The rudder is placed in a large opening in the stern, and is fastened chiefly by means of cables, so that it can be occasionally taken up to avoid sands and shallows; but its power is thus greatly diminished by the constant slackening of the ropes, which connect it with the ship. Their anchors are made of a hard and heavy kind of wood, called Tie-moo, *iron-wood*, which they consider as less apt to bend than those which are made of iron; but, in

Pitch. **Hold.** **Size and tonnage.**

general, their extremities are pointed with that metal. Instead of pitch, the Chinese use a kind of gum or oil, called Tong-Yeoo, mixed with lime and threads of bamboo, a composition which hardens in the water, and becomes completely impenetrable; so that a well or two in the hold, or even one only below the main-mast, and which they empty with buckets, instead of pumps, is sufficient to keep the ship perfectly dry. The hold is divided into a number of smaller holds or spaces, with partitions of plank three inches thick, and so carefully cauked with the above mentioned gum, that no water can pass from the one to the other. This plan is attended with obvious benefit in the event of a leak appearing, as the water is thus confined to the particular apartments in which the injury has been sustained; and it might be adopted with advantage by other nations, especially in these vessels, which are designed for distant voyages. These Chinese merchantmen, according to Grosier, are seldom above 90 feet long; but, according to Osbeck, sometimes 200; according to Grosier, seldom above 300 tons burden; according to De Guignes, they are often 600 tons; and Mr Barrow speaks of them as sometimes carrying 1000 tons, with a crew of 500 men. A vessel of this size frequently belongs to 50 or even 100 merchants; and is divided into as many compartments as there are partners. Each of these partners ships his goods in his own birth, which he fits up according to his pleasure; and either goes himself, or sends a son or other relative to take the charge of them. These ships of the Chinese seldom draw as many feet of water, as those of Europe draw fathoms; and are particularly adapted in this respect for the shallow seas, which wash the eastern coast of China.

Ships of war.

The Chinese ships of war are constructed in a similar manner with the trading vessels, except that the two ends are less elevated above the level of the deck, and that the bottom is more narrow. They carry strong carabines and small cannon, and have their port-holes extremely contracted. The soldiers on board are armed also with lances and bucklers, and are frequently protected by a parapet of bamboo along the sides of the vessel. Some of the government galleys have sharp prows; and one kind, which is called *a hawk's bill*, is equally pointed at the stern as at the bow, so that it can advance or retreat without putting about. None but the ships of war are permitted to carry arms; and the traders, when attacked by pirates, have no other means of defence, but stones or sharp-pointed poles of bamboo.

Fishing boats.

Their fishing boats, of the larger class, are peculiarly excellent, and sail in a superior style. They are strongly built, furnished with decks, and can each accommodate eight or ten fishers, with their wives and children. They generally sail two of them in company; and, unless compelled by storms to make for the land, they keep the sea throughout the whole year, and send their fish ashore by the smaller fishing craft, or by boats of their own, which they keep on board for that purpose.

Shipwrecks.

The number of Chinese ships lost at sea is very great; and it was in consequence of the frequent shipwrecks experienced by the vessels, which were employed in transporting the taxes, or tenth of the produce, from the ports of the middle and southern provinces to the northern capital, that the Imperial canal was projected and executed. The whole awkward construction of the large trading vessels, and especially the great height of their upper works, render them very ill adapted to encounter those violent tempests, which occur in the Chinese seas, and which are called in their language Tay-fung. "Were it possible," said a commander of an East Indian ship to Mr Barrow, when describing the fury of these dreadful hurricanes, "to blow ten thousand trumpets, and to beat as many drums, on the forecastle of an Indiaman, in the height of a Tay fung, neither the sound of the one nor the other would be heard by a person on the quarter-deck of the same ship." These heavy gales prove fatal to such vast numbers of the Chinese vessels, that ten or twelve thousand persons from Canton alone are supposed to perish annually by shipwreck. Hence, when a merchantman leaves that city upon a voyage to foreign parts, it is considered as an equal chance, whether it shall be lost or return; and when the event is prosperous, a general rejoicing takes place among the friends of those who had embarked in the hazardous enterprize.

MONEY AND WEIGHTS.

The ancient money of China is said to have been chiefly shells; but very little can be known on the subject, as the Chinese themselves affirm, that the Emperor Shee-hoang-tee destroyed all the coins, as well as books and other monuments of preceding times. In the year 160 before Christ, the Emperor Ven-tee first permitted the indiscriminate coinage of money by private individuals; but Kao-tsoo, founder of the dynasty of Tang, A. D 619, was the first who regulated the weight and impression of the current coin. The Chinese currency has consisted, at different times, in copper, tin, lead, iron, baked earth, shells, and even paper, according to Marco Polo; but the two latter were soon abolished; and though, in consequence of a scarcity of copper, the Emperor Hong-voo again attempted to bring it into use, A. D. 1368; the Chinese could never be induced to exchange their bullion and property for so unsubstantial an equivalent.

Coin.

Gold is regarded as an article of traffic; but silver and copper form the present currency in China. The silver, however, is never reduced into the shape of coin, but is cast or cut in the form of bars or plates, of different sizes, which, like the Roman *as*, or the Hebrew shekel, are valued according to their weight; and, while the larger bars are employed in paying the more considerable sums, the smaller are cut down into minute portions, according as circumstances require. Hence, a Chinese is always provided with a pair of scissars, a pair of scales, and a set of weights, for the purpose of preparing on the spot the necessary value in bullion. The mode of reckoning the value of silver, is by the number of hundredth parts of alloy which it contains; thus, silver of $\frac{99}{100}$, is that which, in one ounce, has only $\frac{1}{100}$ part alloy. The current silver is from $\frac{98}{100}$ to $\frac{91}{100}$, or even lower, according to circumstances. The government, however, receives nothing but pure silver; and hence, in making any payment to the state, three or four ounces must be added to every hundred, according to the quality of the metal.

There is strictly speaking, therefore, no other coin in China, but of copper; and this is restricted to one denomination, viz. a *Tcheng*, which is scarcely equivalent in value to the third part of a farthing of sterling money. It is a round coin, about $\frac{9}{10}$ of an inch in diameter, with a square hole in the middle, the name of the emperor on one side, and two Tartar words on the other; weighs one *tsien* and two *fen*, and is equivalent to the $\frac{1}{1000}$ part of a tael, or ounce of silver, supposing each of them to be of the standard quality. This copper coin is melted, and not struck; is mixed generally with some inferior metal, chiefly toutenago,* which renders it remarkably brittle, and of a whitish colour; but the government, which has the property of all the mines in the empire, takes great care never to suffer the price of copper to fall so low, as that a profit might be made by counterfeiting the current coin; nor to rise so high, as to endanger the melting of the copper money for articles of manufacture. They are careful also to maintain a due proportion between the quantity of silver and copper in circulation; by making all their payments for a time in silver, when that metal is become scarce, or in copper, when the reverse is the case.

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* Toutenago, or tintenac, is generally considered as a kind of brittle calamine, chiefly composed of zinc and copper; but M. De Guignes contends, that its properties (especially that of imparting to copper a white colour, and rendering it less liable to verdigrease,

The Chinese count by Leang, tsien, and fen, or by taëls, mas, and condoreens, according to the Portuguese, which are only different names for the same pieces.

Table of Chinese Money.

	Sterling.
10 Tcheng, or cas, or deniers = one condoreen or fen	= $\frac{4}{5}$*d.*
10 condoreen or fen = one mass or tsien =	8*d.*
10 mas or tsien = one taël or leang =	6*s.* 8*d.*

Europeans at Canton generally make and receive payments in Spanish dollars, which are about 4s. 6d. sterling in value, and in quality about $\frac{94}{100}$, though accepted by the He-poo, or collector of customs, only at the rate of $\frac{91}{100}$. Most of the money of other nations, received in China as payment, according to its weight and quality, is afterwards melted down, and converted into articles of luxury, or useful utensils; and it is said, that no nation in the world is better acquainted with the value of the precious metals, or more ingenious in drawing them out to the greatest degree of thinness.

Interest of money.

The rate of interest in China, even as authorised by government, is extremely high, varying from 12 to 18, and even to 36 per cent. Among the various conjectures, which have been proposed as to the reasons of so exorbitant an interest being permitted, the most rational seems to be, that the legislature has thus wished to prevent the possessors of money from having any inducement to make great purchases in land, which might derange the whole system of their policy and administration. Foreigners in Canton lend to the Chinese upon the security of property, at 12 or 18 per cent.; and, if more is ever given, it is rather by way of a *premium* or *bonus*. There are in every city, numerous shops or offices, called Tang-pan, which lend money upon interest, even to unknown individuals, upon articles, being lodged in pawn; and that persons may have access to those offices without being publicly seen, they are generally behind the street, or in some back lane, to which an inscription in the front or main street gives a direction. The Tang-pan, after having estimated the article offered in pawn, lends a sum of money, generally to the amount of one third of the value, and delivers to the borrower a numbered ticket, specifying the article pawned, the value fixed upon it, the sum advanced, the rate of interest, (generally in these cases 18 per cent.) and the term of agreement. Upon presenting this ticket, and repaying the sum with the interest, the article is returned; or the article itself may be retained at the value put upon it, as part of the payment. These tickets may be presented by any person, to whom they may be entrusted or made over by the original borrower; but, if not produced at the time specified, the proprietor loses all right to the pledge, which the Tang-pan then applies to his own benefit.

Weights.

The weights in China vary in different quarters, perhaps to the amount of five pounds more or less in every hundred; but the weights, used by the tribunal of finances, by which every thing due to government is weighed, are the acknowledged standard. Besides the Chinese names for the different denominations, there are corresponding terms in use among Europeans at Canton, which are also given in the following

Table of Weights.

10 Lee or Tcheng = one Condoreen or Fen,
10 Condoreen or Fen = one Mas or Tsien,
10 Mas or Tsien = one Taël or Leang,
10 Taëls or Leang = one Catis or Kin, or 1 lb.
100 Catis or Kin = one Pic or Tan, or 1 cwt.

Long measure.

There is some variation also in the Chinese measures of length, especially in the foot; which is represented by some authors as a few lines longer, and by others as a few lines shorter than the English foot. The Chinese foot or Cobb, or Tche, is divided into ten Tsien, corresponding to inches, and these into ten Fen, nearly equivalent to lines.

Table of Measures of Length.

10 Fen or lines = one Tsien or inch
10 Tsien or inches = one Tche or Cobb
10 Tche, or feet = one Tchang

TRADE.

Trade is not much honoured or encouraged in China. The merchant, who carries on the inland commerce of the country, is ranked far beneath the poorest husbandman; and the man, who engages in foreign traffic, is accounted very little better than a vagabond. The trader, in short, is looked upon as the lowest character in the empire, as a person who will cheat whenever he has the opportunity, and as one whose business consists in creating and supplying artificial wants.

Home Trade.

The home trade alone is regarded as necessary, and as deserving the protection of the government. It consists in the interchange, between the different provinces, of the various goods and manufactures, which they severally produce; and no nation in the world has done more than the Chinese for the establishment and prosperity of an extensive inland commerce. The natural advantages of their country, which is traversed by a multitude of rivers in all directions, have been improved to the utmost; and by the construction of canals and boats of every size and form, the conveyance of every article of merchandise has been facilitated in a manner altogether unexampled. A trader can pass his boat with his goods from one extremity of the empire to another, by paying a small transit duty to the state, and a few tolls upon the different canals and rivers, for the repair of bridges, flood-gates, embankments, &c. This home traffic may be said to be carried on chiefly by barter; and employs such an amazing quantity of small-craft of every description, that it has been calculated to equal in number and tonnage the whole floating vessels in the rest of the world. The principal productions of the different provinces, which forms this commerce, have already been enumerated under the first head of this article, viz. the description of the country; and we may only here remark, that, even in their dealings with each other, the Chinese exercise the utmost degree of distrust, and practise every species of imposition. Of the multitudes of buyers and sellers who crowd the large cities of China, it has been said, that the one half are employed in over-reaching the other. But of this every one is expected to be aware; and their common saying, therefore, is, that it is not the merchant who cheats, but that it is the buyer who cheats himself.

Foreign commerce.

Their foreign commerce is extremely limited; and the

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while zinc on the contrary communicates to copper a golden colour, and makes it more subject to verdigrease) demonstratively prove that zinc is not the base of toutenago, which he affirms to be rather a compound of iron, lead, and bismuth, which last is known to have the property of whitening copper.

prevailing prejudices of the people, as well as the uniform policy of the government, are adverse to its increase. The Chinese consider their own country as so superior to all others, that they are very reluctant to leave it, even in the prospect of gain; and they have so thorough a contempt for all other nations, that they regard as infamous characters, all those who go to make a fortune among foreigners and barbarians. Those, who do venture abroad for purposes of traffic, are bound to return in a limited time. Those, who remain in foreign countries, are looked upon as outcasts from the empire; and should they suffer any injury or calamity, the government pays no attention to their case. Those, who embark in European vessels upon mercantile speculations, must do so with the utmost secrecy, and also guard against a discovery upon their return, as they would then be pillaged by the mandarins and soldiers, as lawful spoil, without the possibility of procuring any redress.

Foreign trade by land.

Their principal foreign trade by land is carried on with the Tartars and Russians. The former branch of traffic is limited chiefly to an exchange of considerable quantities of coarse tea, for horses, to supply the deficiencies which occur in the ranks of the cavalry. The latter is more extensive; but has been subjected to various alternations and interruptions in its progress. It commenced about the period of the invasion of China by the Mantchoo Tartars; and was first attempted by a governor of Tobolsk, who sent persons of confidence to Pekin, in aid of his commercial plans. In consequence of the opening which was thus effected, a number of Russian and Siberian traders united in 1670 in forming a caravan for Pekin, which succeeded so well as to encourage new companies, and to attract numbers of adventurers. The Chinese government soon became alarmed by these advances of a powerful neighbour, and erected a chain of forts along their northern frontiers, which gave rise to a succession of slight hostilities between the two nations. At length, in 1689, by the mediation of Fathers Gerbillon and Pereira, acting by the authority of the Chinese Emperor Kang-hee, the two courts entered into a treaty of peace and perpetual alliance, which was signed at Nertschinsk, and engraved on two pillars at their respective frontiers. A free commerce was thus permitted to all the subjects of these two extensive empires, who were furnished with passports from their respective governments; for which privilege, Russia made several important concessions, especially the liberty of navigating the river Amour, as far as the Eastern Sea. In 1692, Peter the Great commissioned Isbrand Ives, a Dutchman in his service, to request from the court of Pekin the same privileges for caravans, which the late treaty granted to individuals. This embassy proved successful in procuring the consent of the Chinese government; and as the court of Petersburgh reserved to itself the right of sending these caravans, the whole profit of the trade was turned from the private subjects to the public treasury of Russia. The journey of these caravans occupied a period of three years. Caravanseras were appointed at Pekin for the exchange of the commodities, and for the residence of the Russian merchants, whose expences, during their stay in the capital, were defrayed by the Chinese emperor. Independent, however, of those caravans, a secret commerce was carried on by individuals, through the agency of the Mogul Tartars. In consequence of the drunkenness and misconduct of some Russians, in the midst of the Chinese capital, a misunderstanding originated between the two countries, which had nearly annihilated this commercial intercourse; but the Chinese were pacified by the embassy of Ismäiloff, a captain in the Czar's life guards; and Laurent Lange remained at Pekin, under the denomination of agent to the Russian caravans, with a view to prevent the recurrence of similar disorders. Upon the subsequent departure, however, of this resident, the Russians renewed their turbulent behaviour; and, by the refusal of the court of Petersburgh to deliver up some Tartar hordes, who had become tributary to the Czar, the Chinese government was so much offended, that every Russian was ordered to leave the empire, and all further communication was prohibited. In 1727, Count Ragouzinskoi, an ambassador on the part of Russia to the successor of Kang-hee, succeeded in once more establishing a commercial intercourse between the two nations; and, at the same time, executed a new treaty, fixing definitively the boundaries of the two empires, and subjecting the traders to such regulations as appeared calculated to prevent the recurrence of discontents on either side. The court of Petersburgh was thus permitted to send a caravan to Pekin once in three years; and the number of merchants composing it, was limited to 200. It was farther stipulated, that, upon their arrival on the frontiers of China, they should inform the emperor of their approach, that a Chinese officer might be appointed to escort them to the metropolis; but that no private individual, unconnected with the caravan, should attempt to enter the Chinese dominions, or to trade within the territories of the Moguls. For the intercourse of private traders, however, two places were assigned on the confines of Siberia, where their merchandise should be deposited, viz. Kiakhta and Zurukhaire, or as the Russians call it Näimatschinn, upon the left bank of the Argoun. Notwithstanding all those solemn agreements and stipulations, continual impediments were excited by the violent passions or dishonest practices of the parties concerned in this commercial intercourse; and, in the space of 26 years, only six caravans were fitted out from Russia to China. Many grievances also were alleged by the court of Pekin against that of Petersburgh, especially in protecting the Kalmuck Tartars and Tongusians in their emigrations towards the Russian territories, and evading all the demands and remonstrances of the Chinese government on the subject. Upon the accession of Catherine II. to the throne of Russia, these disputes were amicably terminated; and the public monopoly of the Chinese trade was renounced, in favour of her subjects in general. Notwithstanding occasional interruptions, by the fickleness of the Tongusians, in withdrawing from the protection of the Russians to their former sovereign, the emperor of China, the merchants of the two countries gradually fell into a closer intercourse, and trade became remarkably brisk and active. Russian factories multiplied at Kiakhta, which became a large and fortified place; and Chinese traders resorted, in considerable numbers, to Zurukhaire. Commissaries on each side presided at the exchange of the commodities; and the Mogul language was employed in the contracts made by interpreters. In these bargains, the Chinese are said to have had a decided advantage, to have traded more in a body, and with a greater degree of circumspection, and to have found means to discover the real value of the Russian articles, while they had the art to sell their own, at the price which they chose to fix at first. Tea particularly is sold, at these trading stations, at so high a price, that the purchasers frequently are unable to sell it again so low as the merchants of Petersburgh, who procure it from England or Holland, and who can send it to be sold at Okotsk at 16 rubles per pound. To indemnify themselves in this traffic, the Russians use all means in their power to raise the price of their furs, of which the Chinese are extremely fond; but they are seldom able to outdo these traders in cunning and caution. In this trade the Russian articles are chiefly furs, cloths, hardware, and live cattle, such as horses, camels, &c.; and the Chinese commodities are silk, cotton, porcelain, rhubarb, musk, &c. By a calculation of exports and imports at Kiakhta in 1777, the amount of this commerce between Russia and China was estimated at £573,656 sterling; and including the contraband trade, which is said to be very considerable, and making allowance for the deficiencies of that year, which is said to have been less abundant than the preceding, the gross amount may be calculated at £800,000 sterling. It has greatly declined, however, since that period; and about the year 1788, was completely at a stand, waiting for the confirmation of a new treaty. It is the opinion of M. Lesseps, from whose travels in Kamtschatka the above information is derived, that the taxes and restrictions upon the traders would require to be greatly reduced; and that it would be the interest of the Russians, instead of pursuing this overland traffic, to fit out ships from Okotsk or Kamtschatka, and to trade directly with Macao or Canton.*

Foreign trade by sea.

The foreign trade of the Chinese, as carried on by their own shipping, is extremely limited; and the equipment of vessels for that purpose is confined to the three ports of Canton, Emouy, and Ning-po. They generally sail to Japan in the month of May or June, with a monsoon from the south-east, and return in October by favour of the north winds. In this trade, they export rhubarb, ginseng, silk-stuffs, strings for musical instruments, eagle and sandal wood, leather, cloth, and sugar; and bring back pearls, gold, red-copper, sword-blades, paper, and varnished articles: making great profit, especially upon their sugar, and supposed to gain upon the whole *cent. per cent.*

Japan.

Manilla.

Their trade to Manilla is accounted only about one-half as gainful, and consists in exchanging silk-stuffs and stockings, embroideries, tea, porcelain, varnish, and drugs; for piastres, rice, birds' nests,† pearls, and dyeing materials.

Batavia.

To Batavia their traffic is more considerable than to any other quarter, and is greatly encouraged by the Dutch. They sail thither in the month of December, with cargoes of porcelain, tea, toutenago,‡ copper vessels, rhubarb, and other drugs; and take, in return, silver, tin, pepper, nutmeg, cloves, tortoise shells, birds' nests, sandal wood, red wood, amber, and European cloths.

Cochinchina.

To Cochinchina they export linen and woollen stuffs, and receive in exchange, gold, areca, and cinnamon.

Malacca.

From Malacca, Siam, and Cambodia, they bring home resin, tin, camphor, birds' nests, elephants' teeth, and the horns of the rhinoceros.

Commerce with European traders.

That species of the foreign trade of China, which is carried on by the ships of other nations, is confined entirely to the port of Canton; and may be said to be a branch of traffic, which is barely tolerated by their government. The court of Pekin, indeed, has frequently indicated a disposition to shut the port of Canton, and of consequence all their other ports, against foreign vessels; and, except the loss of the customs, drawn by the emperor, and the injury, which the city of Canton would sustain, it has been questioned, whether the Chinese nation in general would lose much by the exclusion. The principal articles, which they receive by this European commerce, and which may be viewed as most approaching to necessaries, are *tin*, which is chiefly employed in making tea boxes, and which would become less necessary were the European demand for that article suspended, or which they might procure as formerly from Batavia and Malacca; *lead*, which is used chiefly for the same purpose, and which would become equally unnecessary from the same cause; *spices*, of which the Chinese do not make great use; *cotton*, of which they could themselves produce abundance, by resuming the culture of the cotton plant, instead of the tea-tree, which they have in a great measure substituted in its place; and *broad cloths*, which are principally used by the wealthier classes, but for which they might easily find proper substitutes.

On the other hand, nothing but the importance of the trade to Europeans, especially the valuable and universal commodity of tea, could induce the merchants of other countries to tolerate the usage, which they experience at Canton, from the very lowest officers of the Chinese government. They are not only received with the utmost indifference, but are often treated with the greatest rudeness, and daily exposed to the grossest extortions. They are compelled to trade with a limited number of Chinese merchants, seldom exceeding eight, who have the sanction of government to treat with foreigners; and who are responsible, on their part, for the conduct of those with whom they have dealings. With these men, and their deputies, the strangers transact business in a kind of mixed jargon of English, Portuguese, French, and Chinese; and, beyond this communication, they have scarcely one indulgence or privilege of any kind. They cannot extend their walk a few hundred yards beyond the limits of the factory, without danger of insult; and are always watched and suspected at every step which they take. The very meanest of the natives are in a manner prohibited from serving them; and almost account themselves degraded by their employment. The import and export duties, ought, by the law of the country, to be levied according to the value of the cargoes or size of the vessels; but are, for the most part, arbitrarily fixed at the fancy of the collector. The Chinese government, indeed, are ready to punish, with confiscation of property, those officers, who are guilty of extortion, and have often shewn great justice and moderation in cases, which were duly represented; yet its vigilance is generally evaded, and its threatenings silenced by the potency of presents; while the foreign merchants, from their ignorance of the language, are unable to bring their grievances to the knowledge of the viceroy, which it would be vain to attempt to transmit through the petty officers or Hong merchants, who are all interested in keeping such things from the ear of their superiors.

These Hong merchants, also, though generally distinguished by the liberality and accuracy of their dealings, have the foreign trader wholly at their mercy, as they possess the complete monopoly of the commerce. They alone are entitled to receive the imported goods, and to furnish the return cargoes. With them the foreigner must of necessity treat; and they are almost equally obliged to insist upon enormous profits, as they are expected to pay for their privileges by frequent and magnificent presents to the superior officers at Canton; and these again must share the spoil with the emperor and his chief ministers at Pekin. Many of these officers at Canton arrive from the capital sufficiently poor; and in the space of three years return thither with immense riches. The various curiosities, jewellery, and other articles of English manufacture, which have been observed in the different imperial palaces, and all of them presents from Canton, exclusive of similar valuables, in the possession of the higher mandarins, have been estimated at a sum equal to two millions sterling.

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* Further particulars of this commerce may be found in Coxe's *Russian Discoveries*, p. 197; and in Pallas's *Reise*, vol. i. p. 232.

† These nests are made by a species of swallow, and are composed of sea worms of the mollusca class, cemented together and fastened to the rocks by means of a slimy matter which issues from the bill of the bird, or which, as others suppose, it collects from the surface of the water. They are small and tough, resembling the half of a lemon-rind; and those are accounted the best, which are white, clean, and free from feathers.

‡ See p. 297. Note.

Commercial tricks of the Chinese.

Of the refined knavery, and undisguised extortions practised by the Chinese upon European traders, and even upon one another, the following instances may be given as attested facts, upon the authority of Mr Barrow. "In consideration of the Hindostan, (a ship employed, in the embassy of Lord Macartney) having carried presents for the emperor, an order was issued from court, that she should be exempt from duties, at any of the ports, where she might take in a cargo. It happened that the Hong merchants had already paid the Hindostan's duties with those of the other ships, of which her particular share was 30,000 ounces of silver. The Hoppoo, or collector, was therefore requested to return this sum, agreeably to the order from court; but he refunded only 14,000 dollars, which can be reckoned as little more than 11,000 ounces, observing that so much was the exact amount of the emperor's duties."

"An Armenian merchant brought a large pearl to Canton, in the expectation of making his fortune. Its size and beauty soon became known, and attracted the attention of the officers and the merchants, who paid their daily visits to the Armenian, offering him prices far inadequate to its value. At length, however, after minute and repeated examinations, a price was agreed upon, and a deposit made; but the Armenian was to keep possession of the pearl till the remaining part of the purchase-money should be ready; and, in order to obviate any possibility of trick, the box, in which it was kept, was sealed with the purchaser's seal. Several days elapsed without his hearing any thing further from the Chinese; and, at length, the time approached, when all foreign merchants are ordered down to Macao. The Armenian in vain endeavoured to find out the people, who had purchased his pearl; but he contented himself with the reflection, that, although he had been disappointed in the main object of his journey, he still had his property, and that the deposit was more than sufficient to defray his expences. On reaching his home, he had no longer any scruple in breaking open the seal; but his mortification may easily be supposed, in discovering that his real pearl had been exchanged for an artificial one, so very like as not to be detected, but by the most critical examination."

"I bought of a blind man in the street," says M. Osbeck, "a Camellia Japonica, which had fine double white and red flowers. But, by farther observing it in my room, I found, that the flowers were taken from another tree, and one calyx was so neatly fixed in the other with nails of bamboo, that I should scarce have found it out, if the flowers had not begun to wither. The tree itself had only buds, but no open flowers. I learned from this instance, that whosoever will deal with the Chinese must make use of his utmost circumspection; and even then must run the risk of being cheated."

"One of my countrymen," says the same author, "can testify this, who buying some chickens, the feathers of which were curiously curled, found, in a few days time, the feathers growing straight, and that his chickens were of the most common sort. The Chinese had curled the feathers up like a wig, a little before he was going to sell them. This is an instance of a Chinese who spares neither time nor pains, if he can only gain money, whether by fair or fraudulent means."

"Sometimes you think you have bought a capon," says Grosier, "and you receive nothing but skin; all the rest has been scooped out, and its place so ingeniously filled, that the deception cannot be discovered, till the moment you begin to eat. The counterfeit hams of the Chinese have often been mentioned. They are made of a piece of wood, cut in the form of a ham, and coated over with a certain kind of earth, which is covered with hog's skin. The whole is so curiously painted and prepared, that a knife is necessary to detect the fraud."

The contempt testified by the Chinese towards foreign traders proceeds not merely from their notions of national superiority, and their low views of the mercantile occupation in general; but is no doubt greatly confirmed by the knavery and deceit, which are sometimes practised upon their own people, by the merchants of Europe. Notwithstanding all their acuteness and caution, they have often been cheated with gaudy watches, and similar articles of indifferent workmanship, purposely fabricated for the Chinese market, and the following instance of English fraud, recorded by Mr Barrow, is not much inferior to those of the Chinese dealers. "One gentleman in the honourable East India Company's employ, took it into his head, that cuckoo clocks might prove a saleable article in China; and accordingly laid in a large assortment, which more than answered his most sanguine expectations. But, as these wooden machines were constructed for sale only, and not for use, the cuckoo clocks became all mute, long before the second arrival of this gentleman with another cargo. His clocks were now not only unsaleable, but the former purchasers threatened to return their's upon his hands, which would certainly have been done, had not a thought entered his head, that not only pacified his former customers, but procured him also other purchasers for his second cargo. He convinced them by undeniable authorities, that the cuckoo was a very odd kind of bird, which sung only at certain seasons of the year; and assured them, that, whenever the proper time arrived, all the cuckoos, they had purchased, would once again tune their melodious throats."

English tricks.

Exported articles.

The principal articles, exported from China in the commerce with Europe, are:—

Porcelain, of various descriptions.

Tea, of which the principal kinds are,

	taels.
Vooy, Booy or Bohea, at from	12 to 15 per pic.*
Song-lo	24—26
Cong-foo	25—27
Sao tchon	40—50
Pekao	34—60
Hay-suen	50—60
Tchu	65—70
Sugar	4—6
Sugarcandy	7—15,

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* The pic is equal to 100 Chinese pounds of 16 taels or ounces.

	taels.	
Cinnamon	12—24	per pic.
Camphor	20—28	
Musk	30—37	per catis or lb
Ginseng	10—18	per tael or oz.
Turmeric	3— 4	per pic.
Rhubarb	36—40	
Dragon's blood	25—40	
Anise-seed	9—10	
Alum	2— 3	
Borax	20—30	
Toutenago	6— 7	
Quicksilver	50-150	

Gold, which as an article of commerce is $\frac{88}{100}$ in quality, and in the form of plates or ingots, of which that from Tonkin and Cochinchina is the best, and is generally formed into long square pieces.

Nankeens, of which there are two kinds, the one in broad pieces, 18 cobbs in length, 100 of which are sold for a price from 66 to 89 taels; and the other in narrow pieces of 14 cobbs, sold from 34 to 65 taels per hundred.

Imported articles.

The principal articles of importation are,

		taels.	
Amber	from	14 to 22	per pic.
Areca nut		2½— 5	
Asafœtida		6— 8	
Azure		18—36	
Cotton of Surat		9—13	
Tin		14—16	
Wax		20—40	
Clove buds		102-160	per catis or lb
Cochenille		200-600	per pic.
Tortoise shell		50-105	
Copper from Japan		12—20	
Gold and silver thread		15—30	
Nutmeg		100-400	
Ebony		11½—3½	

Pepper from Bencoolen or Batavia, at from 11 to 15 taels per pic; from the coast of Malabar, at 14 to 16.

Sandal wood, of the best quality, sells from 20 to 30 taels per pic; of the second, from 12 to 25; and of the third, from 10 to 16.

Tobacco, from the coast of Brasil, at 70 piastres per pic, even for the inferior kinds, and in 1797 rose to 150 piastres.

Ivory sells from 20 to 72 taels per pic, according to the size of the tusks.

Camphor from Borneo, of the first quality, from 1100 to 2000 taels per pic; of the second quality, from 600 to 1300; of the third quality, about 400.

Coral, in small grains about the size of a pea, sold in 1797 at 40 to 50 taels per catis or lb; but in pieces of a tael and a half in weight, and of a rose colour, at 1400 piastres per piece, and of two taels in weight at 2000.

Steel, which sells best in China, when in pieces of nine or ten inches in length, or about one inch square, at four to seven taels per pic.

Ginseng of Canada, which formerly sold at 500 taels per pic; but, having now lost its quality and character,* only brings from 30 to 45, which scarcely pays the duty upon it, and it can therefore be sold only as smuggled goods.

Birds nests † as articles of food, sell at a price from 1600 to 2500 taels per pic for those of the first quality, from 900 to 1800, for the second; and from 800 to 1000, for the third.

Opium, which in 1810 was more strictly prohibited by an edict of the government, has generally been secretly sold at a greater or less price, according to its quality, and the quantity in the market; but almost always with great profit.

Rabbit and Otter skins, and other furs, were wont to be in considerable demand, but the market has frequently been overstocked.

Glass, mirrors, pearls, gold watches, are all very gainful articles of merchandise at Canton.

Manner of proceeding in the trade at Canton.

As soon as a foreign vessel is moored in the roads of Macao, the Captain must go ashore to give information of the nation to which he belongs, of his own name and that of his ship; and then procures a pilot, who is intrusted with the further navigation of the vessel. When the trader has arrived at the Bocca Tigris, or mouth of the river of Canton, the mandarins send a soldier on board, who remains in the ship till it reaches Wampoo, and till the boats of the custom-house at that place are fairly along side. From this period, no article enters or leaves the ship without being first examined, and having paid the duties, except provisions, which pass free. At this place the ships generally begin to unrig; and the Chinese soon erect on the shore sorts of shades or tents of bamboo covered with matting, for the reception of the rigging, or the accommodation of the sick on board. About three or four days after the arrival of the vessel, the Ho-poo, or collector of the customs, comes on board with the Hong merchants and interpreters; and proceeds to take the measurement of the ship before permission is granted to land the cargo. This measurement is made first along and then across the deck, and the amount of these two quantities, multiplied together, is the result required. If this surface exceeds 154 Tchang, each of which is equal to ten Chinese feet, the vessel is ranked as a first rate, and pays for each Tchang seven taels four mas, four condoreens, and eight deniers; if it exceeds 120 Tchang it is accounted a second rate, and pays for each of these measures, six taels, eight mas, four condoreens; if below 120 Tchang, it is regarded as a third rate, and pays for each, four taels, seven mas, eight condoreens, eight deniers. Besides the duty upon this measurement, every foreign trading vessel indiscriminately pays to the Ho-poo by way of present 1950 taels=L. 650; and hence, in the commerce with China, it is evidently more advantageous to employ one large ship, than two of a smaller tonnage. The articles on board are then conveyed to Canton in Chinese boats, at the expence of the foreign trader; and being carefully noted, as they are put into these boats, are marked at every custom-house on the route, and finally examined at Canton in the European factory, or in the warehouses of the Hong merchants; but it is recommended to the foreigner to have one or two sailors from the vessel on board of each boat, both in loading and unloading, as the Chinese are remarkably dexterous in committing depredations, and substituting false chests or bales in the place of those which they purloin. The money for the purchase of the cargo is sent up in the ship's boat; and as none is allowed to be again withdrawn, when once landed in the country, it is necessary to retain on board whatever is not intended for this purpose. Copper and iron are subject to the same regulation; and, though destined solely for the use of the vessel, yet, if once sent ashore, are not easily recalled on board.

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* See article CANADA, Vol V. p. 341.

† See p. 300. Note.

The ships are loaded at the expence of the Hong merchants, and generally complete their cargo at Wampoo, unless they draw so much water as to require to be carried farther down the river, before receiving the whole of their burden. When the loading is completed, the captain sends intimation to the Hong merchant, who then applies to the Ho-poo for the license to sail and to procure a pilot; and this license ought to be preserved till the vessel has passed Macao, both as a proof that all the duties have been paid, and as a claim upon the Chinese for assistance in case of accidents. After the departure of the ships for Europe, the supercargoes of the companies at Canton begin to bargain with the Hong merchants for the next cargo; and, by acquiring on the spot a knowledge of the situation of these merchants, and of other circumstances, they have thus greatly the advantage of private traders, in making profitable contracts.

Expences of trade.

The following table of expences, attending a commercial voyage to Canton, according to the statements of M. De Guignes, * may be acceptable to mercantile readers:—

	Dollars.
Duty upon a ship 50 Chinese feet in length, and 20 in breadth = 1000 feet, or 100 Tchang . .	665
Present to the Ho-poo, about	2708
Two per cent. upon the two payments for the secretaries of the Ho-poo	67
Expence of pilot to Wampoo	40
Additional gratification	4
Hire of a lodging at Canton	600
Licence for each country boat employed in unloading the cargo	15
Hire of the boat, &c.	9
Salary to interpreter, and expence of licence to sail	184
To the mandarins at Wampoo	200
To the comprador, or purchaser of provisions .	200
To the soldiers	4
To the mandarins upon leaving Canton	6
To the pilot, for going down to Macao	60
To the boats, which assist in passing the bars . .	4
Total about L. 1150, or	4766

The fare of the country boats from Canton to Wampoo, is generally from four to six dollars; but it is recommended, upon finally quitting Canton, to use the ship's boat, instead of the Chinese craft, which would expose the trader to demands for money at every custom-house. †

MANUFACTURES AND TRADES.

Porcelain.

Few of the manufacturing arts have attained any high degree of excellence in China; and almost the only one, in which they excel, is in the art of pottery. Even the superior quality, however, of their porcelain, is more owing to the excellence of the materials which they possess, and the care with which they select and purify them, than to any ingenuity or skill displayed in the process. Their taste in shaping and ornamenting their porcelain vessels is generally acknowledged to be most wretched; and they can neither finish nor paint their ware in a manner equal to that of European manufacture.

Materials.

The two principal substances, which enter into the composition of their porcelain, and upon the due preparation and proportioning of which its quality depends, are called Kao-lin and Pe-tun-tse: the former, is a fine soft clay, or soap-stone, mixed with a few grains of mica; and the latter a kind of granite composed chiefly of quartz, with a small quantity of mica; the whitest of each, and that which has a greenish hue, is always preferred, and carefully purified. The Pe-tun-tse, after being broken by an iron club, is pounded in mortars by means of levers, headed with stone and bound with iron, which are sometimes worked by water like the hammers of paper mills. The powder is then thrown into a large vessel full of water, stirred with an iron shovel, and left to settle. A kind of cream, about four inches thick, then rises to the top, which is repeatedly scummed off as it collects, and poured into another vessel filled with water. The dregs, which remain behind, are then pounded anew, and submitted to the same process. The cream, thus collected, is allowed to remain in a vessel of water, till it form a crust at the bottom, and the water above become perfectly clean, which is then gently poured off, and the paste thrown into large moulds to be dried; but, before becoming entirely hard, it is cut into small square cakes like bricks, which are sold by the hundred.

The kao-lin is found in large mines, under a stratum of red earth; and, though almost sufficiently prepared in its natural state, is made to pass through the same process, and formed into bricks like the Pe-tun-tse.

These two substances are then mixed together, the kao-lin acting as a cement to unite the particles of the Pe-tun-tse. For the fine porcelain, equal parts of each are employed; for that of a secondary quality, four parts of the kao-lin are added to six of the Pe-tun-tse; and for that of the lowest kind, one part of kao-lin to three of Pe-tun-tse. Instead of kao-lin, the manufacturers sometimes employ a kind of greasy chalk-stone, named Hao-tche, which is pounded, purified, and formed into cakes, in the same manner as the other substances. The porcelain, made of this material, is finer, whiter, and lighter, but, at the same time, more brittle and expensive, than what is made with kao-lin; and, hence, the workmen generally content themselves with dipping the formed paste into a thick tincture of Hao-tche, for the purpose of giving it a greater degree of whiteness. Another kind of substance of the nature of gypsum, called She-kao, is also occasionally used, but it wants the solidity of the kao-lin.

Mode of working.

When the substances are mixed in the desired proportions, the mass is thrown into a large pit, well paved and cemented; and is then kneaded chiefly by treading, till it become hard. From this mass the workmen take their portions, which they spread out upon large slates, and knead and roll the substance in every direction, destroying every vacuum, and removing every extraneous matter, even the smallest hair or grain of sand. Vessels with plain surfaces, are then formed, generally with the wheel; and, when a cup has thus received its proper height and diameter, it passes to another wokman, who forms its base; then to a third, who gives its proper shape by a mould; then to a fourth, who polishes its edges, and diminishes its thickness; and so on, through a variety of hands, perhaps to the number of 20, before it is ready for the furnace. In the larger and more complicated pieces, in which there are spouts, handles, rings, &c. and in figures of trees, animals, busts, and other ima-

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By this author, the dollar is estimated at nearly 4s. 10*d.* sterling.

† For a variety of other useful and particular directions respecting the navigation from Macao to Wampoo, we must refer to *Voyage a Peking* par M. De Guignes, tome iii. p. 277.

Manufactures.

ges, which are fashioned upon moulds, or modelled by the hand, the different parts are prepared separately; and, when nearly dry, are cemented together with paste, of the same nature as the substance, of which they are composed; while the seams, being polished with a knife and covered with varnish, are completely concealed. When a piece of porcelain is thus properly fashioned, it passes into the hands of the painters, one of whom traces out the circle to be coloured around the brim, another designs the flowers, a third the mountains or rivers, a fourth the animals, a fifth the human figures, and a sixth applies the paint. When the porcelain has received its form, colours, and ornaments, it is then conveyed to the furnace; and each piece is put into a separate case or box, the bottom of which is covered with a layer of fine sand, over which again is thrown powder of kao lin. The case is covered by the bottom of another case, which enters it only so far as to shut it entirely, without touching the porcelain below; and these piles of cases are then placed in the furnace, upon a bed of coarse sand, the finer kinds being in the middle, the coarser at the farther extremity, and those, which have most body and strongest colours, at the mouth. These piles are placed closely together, and made to support each other by pieces of earth at the top, bottom, and middle; but still so as to allow the flame to find a free passage on every side. It seldom happens that a baking succeeds entirely; and from too strong a heat, or insufficient cases the whole is sometimes completely spoiled, and the porcelain and cases found converted into a shapeless mass, as hard as flint. Hence smaller furnaces are more frequently used; and the cases are introduced into the furnace, and taken out when supposed to be sufficiently baked, by means of a long wooden handle, with an iron plate at one extremity.

Different kinds of porcelain

The Chinese name for porcelain is Tse-kee; and the best is made in the village of King-te-ching, in the province of Kiang-see. The finest is reserved for the emperor; and it has been questioned, whether any of the largest and most beautiful pieces have ever been brought to Europe. The porcelain pieces are painted of various colours; but the most prevailing is white, with blue flowers; and the greater part of what is transported to Europe is of this colour. An inferior kind, entirely white, is also brought to Canton, in order to be painted there, according to the orders of the European merchants. It is said, that one of the most esteemed and expensive kinds is of a red colour, which is sometimes uniform throughout, and sometimes merely sprinkled in the form of small spots; which is done by dipping the end of a pipe covered with gauze into the colouring matter, and then blowing it upon the porcelain. There is also a black or lead coloured porcelain, sometimes interspersed with gilding, which is in great request; and this gold colour is prepared by rubbing with the palm of the hand, in a plate of porcelain, gold dust mixed with water and sugar. It is then applied with a pencil dipped in clear gum-water; and, when the vessel has passed through the furnace, the gold is polished with a fine wet sand.

Earthen ware.

Besides porcelain, they form very beautiful vases of a brownish coloured clay, some of which are from three to five feet deep, and four or five in diameter; the finer kinds of which are used for holding gold fishes, flowers, aquatic plants, &c. and the coarser are employed for keeping seeds, fruits and water. In this manufacture, particular attention is paid to the wants of the people, and they are supplied, at a cheap rate, with spoons, cups, lamps, and various kitchen utensils, of this baked earth. There are vases also of fuller's earth, which are used for cooling and sweetening water; and a coarser kind of earthen ware, which is supposed to communicate a more delicate taste to rice, when boiled in it, and is therefore much used in culinary purposes.

Manufactures.

Glass.

It has been considered as a remarkable instance of the want of ingenuity in the Chinese, that they should have been so long in possession of the art of making porcelain, so analogous to that of glass, without having discovered the mode of producing this useful manufacture; and it is said, that they even profess to hold it in very little estimation. At the recommendation of the Jesuits, a French family, made an attempt, in the last century, to introduce this manufacture at Pekin, but failed of success. In Canton, they have learned to melt old glass, and cast it in a new form; but their common mirrors are still generally made of a polished metal, which is supposed to be a compound of zinc and copper. A glass-house is said, indeed, to be kept up at Pekin, where a few vases and other articles are made; but is regarded merely as an establishment of pomp, and as an appendage to the splendour of the court.

Cloth manufacturers.

Their cloth manufactures do not appear to have undergone any recent or progressive improvement; but, from their close adherence to ancient practices, they have long remained entirely stationary.

Silk.

The use of silk has unquestionably been known in China from a very remote period; and mention is made of a kind of brocade in the annals of Tcheoo, about 780 years before Christ. There are strong grounds, however, for the belief, that the culture of the silk worm was first introduced into the Chinese empire by a colony of Jews, after the expedition of Alexander to India had opened a communication with these countries; and is at least certain, that they are the best manufacturers of that article in China, and abound chiefly in the silk provinces. But, in whatever way, and at whatever period, the manufacture of silk was introduced, it has been cultivated to such an amazing extent, that, besides the immense quantities annually exported, it forms the principal clothing of the greater part of the inhabitants. The best is produced in the province of Tche-kiang, and is distinguished by its superior fineness of texture, softness to the touch, and whiteness of colour. The greater quantity of silk stuffs are manufactured in the province of Kiang-nan, and its capital Nankeen, from which is procured all that is intended for the use of the emperor. The Chinese manufacture this substance into a great variety of stuffs, plain, striped, flowered, napped, clouded; gauzes, velvets, and brocades of every different colour, especially violet, red, yellow, and black; and a multitude of other kinds, whose names even are unknown in other countries. They make several kinds similar to those of Europe, but very inferior in point of workmanship. Neither are the silk buttons, ribbons, and stockings, which they manufacture in Canton after foreign patterns, equal to those of France and England. Their velvets are bad; their Nankeen and Pekin satins are very unequal, and liable to cut. Their gold brocades, though extremely brilliant, when fresh from the hand of the workman, are easily tarnished by air and moisture, as the gold, which they employ, is only a kind of gilt paper. They excel chiefly in the manufacture of gauzes, both plain and flowered, of great variety and beauty. There are two kinds, which are more generally used in the country than any other. The first, called Too-an tse, is a kind of satin, much stronger, but with less lustre, than what is manufactured in Europe. The other, a sort of greyish coloured taffety, is very closely woven, and yet extreme-

Manufactures.

ly pliable, is not apt to cut, and washes, like cotton cloth, without losing much of its lustre: it is chiefly used for linings, drawers, and other under parts of clothing. There is another kind, called Kien-tcheoo, which is manufactured from the silk of an insect, somewhat different from the common silk-worm, and which abounds particularly in the province of Shang-tong. This stuff is very inferior in point of lustre, rough grained, and at first sight resembling the woollen cloth called drugget; but washes well, lasts long, is not easily spotted by grease, and is greatly esteemed by the Chinese. The greater part of the wrought silk stuffs exported to Europe, is manufactured at Canton, or in its vicinity, with the silk of that province, which is rather of an inferior quality. The exported raw silks are from the province of Kiang-nan. And it has been recommended to those who purchase either kind, to inspect the bales and boxes with care; and particularly to examine them internally, as they are often made up within of very inferior sorts.

Nankeen.

The stuff, so well known by the name of Nankeen, is made of cotton from the province of Kiang-nan, which naturally possesses the peculiar yellow hue, which distinguishes the cloth in question; but it is said to lose this colour, when cultivated in the more southern provinces, though it has been raised in great perfection, both as to the size and colour of the pods, at the Cape of Good Hope.

Linen.

The Chinese linen cloths are generally narrow and firmly wrought. One of the best sorts is from Nankeen; and another kind from the province of Fo-kien, called by the Chinese Ko-poo, and by the Portuguese Noonés, is very light, clear, and glossy.

Paper.

In the more early ages, the Chinese wrote with an iron style upon tablets of bamboo, or plates of metal; afterwards also upon cloth and silk stuffs; and at length, in the reign of Ho-tee, about 150 years before Christ, a mandarin named Tsay-lun produced the first paper from the bark of trees and old linen. In this manufacture they have greatly improved, and produce it in immense quantities. They employ, in making different kinds of paper, hemp, nettles, and similar plants, the bark of the mulberry, and of a tree called Koo-tchoo, the straw of rice and other grain, the cods of the silk-worm, and the cotton shrub, rags, and old paper, and especially the bark and fibres of the bamboo. That which is made from cotton rags is the best, remarkably white, soft, and durable; but that from the bark of the Koo-tchoo is most commonly used, and hence paper is generally called by that name in China. In making it from bamboo, the second bark, which is soft and white, is chiefly used, is macerated in water, boiled in kettles, reduced to a paste by pounding in mortars, moulded in frames made of fine threads of bamboo, and often formed into sheets from three to ten feet in length, one of which is sometimes sufficient to cover the whole side of a room. The finer kinds of writing-paper are dipped in a solution of two ounces of alum, and six ounces of well purified isinglass, in twelve pints of water; an operation, which renders them very smooth, soft, and white, and also prevents the ink from sinking; but, at the same time, makes them more apt to cut, to be injured by moisture, and attacked by worms. A particularly strong and beautiful kind of paper is used at Pekin in the windows, instead of glass, which is of a rose colour, and so thick as to be easily split into two or three laminæ. It is said to be brought from Corea, and to be partly composed of the tow of silk.

Ink.

The Chinese are said to have received their improved methods of preparing ink from the Coreans, and to have possessed the art in perfection only since the 9th century. The Chinese ink is made from blacking, produced by the smoke of different substances; but principally that of pines, and of oil in lamps, mixed with strong isinglass, and a little musk to correct the odour of the oil. These ingredients are formed together into the consistency of paste, divided into cakes, and put into moulds. The best is made of the lightest soot, produced by oil in lamps, with isinglass of ass's skin; and the principal manufacture of this superior kind is in the district of Hoei-tcheoo-foo, a city in the province of Kiang-nan, where the workmen are supposed to possess some secrets in the process, which they conceal even from the rest of their countrymen. They have apartments, divided into a multitude of small cells, in which lamps or pieces of pine wood are kept continually burning, to produce the proper blacking; and different kinds of oil are burnt in the different apartments, each of which yields a particular sort of ink. The Chinese are said to possess the art of washing this ink from written paper, and of then separating the ink from the water, so as to be again fit for use, while the paper also is beaten, boiled, and formed into new sheets. Good China ink, should have a smooth and shining fracture, when the stick is broken; should shew a good black colour, when pounded and mixed with water; should dissolve easily, and flow freely beyond the pencil. The cakes should be preserved from moisture; and, if accidentally wet, ought not to be exposed to the sun, which makes them break into chaps or cracks.

Trades.

Hair pencils.

The Chinese use in writing, pencils or brushes of different sizes, made of the hair of various animals, but chiefly that of the rabbit. In writing, they hold the pencil perpendicular between the thumb and the two first fingers, so that the point is fully an inch beyond the little finger, while the hand rests upon the wrist. They write from top to bottom, in the form of columns, beginning on the right of the page; so that, upon commencing a new line, the hand covers those which were last written; a circumstance, which would often occasion great inconvenience, if their ink had not the quality of drying quickly.

Mode of writing.

Printing.

The art of printing was invented in China, about 950 years after the birth of Christ; but it is more like the engraving on copper-plates, than the moveable types of an European press. The characters are first written out by a fair and skilful writer, on sheets of thin transparent paper. These are then glued upon boards of hard wood, generally of the apple or pear-tree, when the engraver, following the traces of the writing, carves the characters upon the plank, afterwards hollowing out the intermediate parts of the wood. Each of these boards generally contains two pages, which are printed on one side only of a sheet of paper, of the same size as the engraved plank, generally royal octavo, and afterwards folded together. The printer places the board in a level position, lays on the ink, which is more fluid than that which is used in writing, with a hard brush; applies the sheet of paper; presses it down with another softer kind of brush, with greater or less force, according to the quantity of ink on the plank; and thus throws off four or five sheets, without having occasion to renew the ink. In this way they can throw off copies, as in stereotype printing, according to the demand; but, as all their works must be executed in the same style, it becomes a very inconvenient matter to preserve the engraved planks, as one chamber is scarcely sufficient to contain those which compose one work, and as they are apt to be injured by the worms. They have also a few moveable types of those characters, which occur most frequently, and which they employ in printing the Gazette, and other smaller publications. In cases of great urgency, such as an edict of government, which may require to be printed in the course of a day or night, the characters are traced and engraved on a block or board, covered with yellow wax, from which the impressions are then taken in the usual way. A Chinese author, must print at his own expence, unless he be a mandarin, in which case he presents his work to the emperor, and, if approved by the imperial college, it is printed at the expence of government. There are numerous printing-offices in China, especially in the city of Soo-tcheoo-foo, in the province of Kiang-nan, where a considerable trade is carried on in books, which are chiefly however collections of poetical pieces.

Seals and wax.

It is the custom in China to give no writing to the public, without the seal of its author. These seals are almost always of a square form, and a few of an oval shape. They are commonly made of a kind of pot-stone, which abounds in the country; but the more wealthy use seals of agate, coral, jasper, and rock crystal. The characters upon these seals are for the most part in the antique form of writing, which is of a square and angular figure; though there are some in the common hand, which are affixed to familiar epistles. The inscription on their seals is either some favourite sentence, or the name of the person to whom they belong; and the impression is made upon a red coloured substance mixed with oil, kept carefully covered in a small porcelain vase, to preserve it from drying, and in a proper state for use.

Engravers.

The frequency of seals gives employment to a number of engravers, many of whom are said to be remarkably expert and ingenious in their profession. They are unrivalled, especially in the art of cutting ivory; and with the simple instrumentality of the hand, they execute in the neatest style, and at a cheaper rate than in any other part of the world, the finest fans, sticks of fans, models of temples and other buildings, and all kinds of toys and trinkets. Out of a solid ball of ivory, with a hole in its centre, about half an inch in diameter, they have been known to cut fifteen distinct hollow globes, one within another, completely detached from each other, capable of being turned round in any direction, and each of them, at the same time, carved full of open work like the sticks of fans. These curious specimens of such nice workmanship, are done by common artists, and in so expeditious a manner, that they may be purchased for a very small sum.

Artists.

The Chinese artists in short are represented as capable of attaining the high degree of excellence in every thing, that requires neatness and delicacy of execution, and might soon excel those of most other countries, if the pride of their government did not discourage the introduction of new inventions and foreign arts. Nothing, it is said, can exceed the ingenuity with which they fabricate the most beautiful toys and finest pieces of mechanism. Mr Barrow relates, as a proof of this remark, that a Chinese at Canton, who had never before seen an European watch, succeeded in making one in every respect similar, except the main spring; and he adds, that, in the short space of half an hour, two Chinese artists took down and put up again, piece by piece, the most complicated glass lustres, consisting of several hundred pieces, which had been sent as presents from England to the emperor; an operation, which was considered as so difficult, that it was thought necessary for the artists who accompanied the embassy, to see it several times performed, in order that they might be able to combine the articles properly, when arrived in China.

Machinery.

The Chinese make very little use of machinery in their manufactures and arts; and the few machines, which they do possess, are of the most rude and simple construction. It is conjectured, that the invention and application of works of machinery is purposely discouraged by the government of that country, lest they should diminish the gains and subsistence of a population already sufficiently in want of employment.

A sufficiently striking proof of the general low state of the most common arts in China, is to be found in the universal practice of the different artisans performing their work, not in their respective shops, but in the houses of their employers; and in the limited number, as well as inferior efficiency of the tools with which they operate. This is not only the case with the menders of iron utensils and of broken glass or porcelain, like the tinkers in Europe, but with almost every kind of handicraft in the empire.

Barbers.

The most numerous pliers in the streets, besides the porters, are the barbers, who are provided with all the necessary apparatus, of a seat, warm water, soap box, brushes, and a variety of instruments, unknown to the same profession in Europe; and they proceed to perform their various services, in the open streets, wherever a customer applies; shaving off every hair on the face, except the eye brows and eye lashes; plucking the hairs from the nostrils, cleansing the ears, adjusting the eye brows, dressing the hair, pairing the nails, and all this for so mere a trifle, that the very lowest of the people are enabled to employ them.

Joiners.

The joiners use few tools, and work clumsily. Their axes are small, and serve also as hammers. Their pincers consist of an iron rod, about a foot in length, and an inch in breadth, one end of which is broader and thinner than the other, and perforated in two or three places; and on the other end, is a quadrangular foot, about an inch square, and sharp at the corners, with a loose quadrangular ring exactly fitted to the foot, by means of which a nail is easily extracted, upon the principle of the lever. Instead of using a bench they sit upon the ground, placing the board of wood against their belly, and holding it with their feet.

Tailors.

Their tailors use very small scissars, and needles with round eyes; and instead of a smoothing iron, they have a little pan of brass or copper without feet, into which they put some burning charcoal, and with which they smooth their seams.

Workers in varnish.

The artists, who make varnished or japanned articles, are very numerous; but those at Canton, whether from the inferior quality of the varnish, or the haste in which they are frequently obliged to work, do not produce such excellent work, as those in the province of Kiang-nan. None of the Chinese artists, however, equal in this department those of Japan, whose productions are greatly valued, and purchased at a high rate in China. Those, who work in varnish at Canton, have their shops in the more retired quarters of the town, and commonly keep their windows shut, as if with a view to conceal the secrets of their art. The articles, varnished, are chiefly made of pasteboard or thin wood; and are almost universally stained of a black shining hue. When the varnish is put on, the articles are carefully preserved from dust, and dried slowly in the shade.

Though the Chinese mechanics are remarkably industrious, frugal, and capable of living upon very little; yet many of them are unable to find sufficient employment and subsistence for themselves and their families. They are often, therefore, engaged in begging as well as in working; but the alms, which they receive, is miserably small, being frequently nothing more than as much rice, as will cover the finger nail. There are, however, mutual associations among those, who follow the same trade, resembling the friendly societies in Great Britain, by means of which, funds are provided for the relief of those who fall into sickness and indigent circumstances.

Fishers.

Among the numerous employments of the Chinese, that of the fishers requires to be particularly noticed; both on account of the multitudes, who are engaged in that profession, and on account of the various modes, in which they practise their art. They use worms and crabs as baits to catch eels and small fish; or drag with great nets, fastened to bamboo poles; or sail up and down with a swimming net, fastened between two boats; or place in the shallows large bamboo and willow baskets, or nets of strong twine attached to stakes. But the most remarkable of their methods are the two following: They have long narrow boats, on one side of which is a large plank painted white, turning upon hinges; and on the other side a net extended the whole length of the boat. When these planks are let down on a level with the water in moon-light nights, or with a fire lighted in the boat, the fish, especially a kind of mullet, deceived by the light and whiteness of the board, leap from the water into the boat. In the other method, they employ a species of corvorant, supposed to be the *pelicanus aquilus*, or *man of war*, which they take out upon the lakes and rivers in boats or rafts. On the neck of the bird is a small iron ring, which prevents it from swallowing the fish, and to this ring is fastened a light cord for pulling it toward the boat. As soon as a fish is seen near the surface of the water, the bird dives towards the spot, and generally brings it up in his bill, from which it is taken by the fisherman; and after labouring a certain time for his master in this way, the ring is taken from his neck, and he is allowed to fish for himself. Though the fishers are permitted to follow their trade without being subject to any exaction or duty, yet they are the poorest and most miserable looking part of the community, perhaps owing in some measure to the bad effects of their fish diet, which, however, they endeavour to correct by the use of onions, garlic, and the flesh of ducks. They raise these vegetables on the waters, on large rafts of bamboo covered with earth, and towed along with their boats; while the ducks are so trained as to leave the boats in quest of food, and return thither, at the signal of a whistle.

CHARACTER AND MANNERS.

Exaggerated estimate of their attainments.

Respecting the general attainments of the Chinese in the most important arts and virtues of civilized life, the most extravagant and contradictory sentiments have been advanced by contending authors. By some, they have been extolled as the oldest, wisest, most learned, most ingenious, and most virtuous of nations, superior to all the other inhabitants of Asia, and capable of standing a comparison with the most enlightened people of Europe. Others again have, in equally unqualified terms, derided all their pretensions to antiquity, science or virtue, condemned their government as utterly abominable, and reprobated their manners as absolutely barbarous. The exalted representation of the empire and inhabitants of China, communicated to Europeans by the writings of the early Jesuit missionaries, are universally acknowledged to have been too highly coloured *in toto*, and to have been altogether unfounded in various instances. These erroneous views no doubt proceeded partly from partial feelings in the minds of the writers, from a wish to ingratiate themselves with a people, among whom they were in a manner obliged to spend the remainder of their lives, and from too implicit a reliance upon the statements of the Chinese themselves; but it may very safely be allowed, without incurring the charge of excessive credulity, that these descriptions of the relatively improved state of China, were by no means so devoid of foundation, at the time when they were made, as they must appear at the present day. Most of them were written, from about the middle of the 16th to the beginning of the 17th century; a period when the countries of Europe were far from possessing that superiority to the Chinese, in a variety of respects, which they have now attained. At that time, there prevailed in China, at least the appearance of an universal toleration of religious opinions; while the nations of the West were distracted by the most irreconcilable schisms, and disgraced by the most inhuman persecutions. While the use of silk was introduced, as a curiosity, by the sovereigns of France and England, the peasantry of China were entirely clothed with that elegant manufacture. When the nobility of England were sleeping upon beds of straw; those of China were reposing on silken mattresses. While the European ladies had skewers instead of pins, and had not even a conception of the present ornaments and utensils of their toilet; the Chinese fair had their needle-work, paint boxes, and trinkets of ivory, silver, mother-of-pearl, &c. When the art of improving vegetables by culture was scarcely known in this quarter of the globe, the empire of China was comparatively a garden. It was scarcely therefore to be expected, that the first European missionaries could have been suddenly introduced to the sight of all these arts and luxuries, without being powerfully impressed with the view, and led to express themselves in the most glowing language. Later missionaries continued to speak in the same exalted terms of the pre-eminence of the Chinese, without duly adverting to the rapid progress of the European nations, and the stationary habits of their favourite China men, who, in those very points, in which they then excelled, are now as far below, as they ever were above the inhabitants of Europe. The discovery of this fact has driven many to the very opposite extreme in judging of the Chinese people; and there is at least candour in the remark, that a fair and sober estimate, founded upon actual observation, would present "little to censure, and less to praise." It is unquestionable, however, that the more that Europeans have had an opportunity of personal observation, and the more they have been made acquainted with the state of things in China, the more have proofs accumulated of the inferiority of this boasted and boasting people in these very respects, in which they were most extolled.

Degree of civilization.

Enough, at least, is now ascertained, respecting their state and habits, to warrant the conclusion, that they are but a little advanced, in civilization, beyond the infancy of what is called agricultural society. It may be readily admitted, that they have been among the first of existing nations, who arrived at a certain degree of excellence; but it is not less evident, that they have long remained stationary, or have even in many things become retrograde; and that, when compared with the nations of Europe at this moment; "they can only be said (in the words of Mr Barrow) to be great in trifles, whilst they are really trifling in every thing that is great." The following assertion of Sir William Jones, (if with any, at least with a very little, qualification,) may safely be adopted, and is gradually more generally adopted on the subject. "Their letters, if we may so-call them, are merely the symbols of ideas. Their philosophy seems yet in so rude a state, as hardly to deserve the appellation. They have no ancient monuments, from which their origin can be traced, even by plausible conjecture. Their sciences are wholly exotic; and their mechanical arts have nothing in them characteristic of a particular family, nothing, which any set of men, in a country so highly favoured, might not have discovered and improved."

Physical character.

The natural colour, both of the Tartars and Chinese, is that intermediate hue between a fair and dark complexion called *brunette;* and those, who are exposed to the influence of the climate, especially the women who labour in the fields, have a deeper colour and coarser features. There is said to be scarcely any apparent physical difference betwixt the Chinese and the Tartars, except that the former are rather taller in stature, and more slender in form than the latter, who are in general short, thick, and robust. The Tartar is also more active, hardy, and able to endure fatigue, possessed of greater firmness of character, and displaying greater fortitude under pain. In the countenances of both, the small eye, elliptical at the end nearest to the nose, is a predominant feature; and both, also, have high cheek bones, and pointed chins, which, with the mode of shaving their hair, gives to the head the appearance of an inverted cone. They have small flat noses, and extremely large ears. Their figure is generally large and square[*]; and nothing is conceived more becoming and reputable than a corpulent habit of body. Among the women, there are few that can be called beauties; and the universal features are a short rounded nose, generally a little flattened, lips rather thick, a small and dark brown eye, with jet black hair. The Mantchoo Tartars are considered as in some degree a mixed race, partly derived from the Greeks of Sogdiana; and among them are sometimes seen fair and florid complexions, light blue eyes, straight and even aquiline noses, brown hair, and bushy beards.

The senses of the Chinese are in no respect easily affected, nor their sensations, of almost any kind, very delicate. They are by no means a cleanly people, either in their persons or dress. They seldom change their under garments for the purpose of washing them; never employ the bath, either cold or warm; make no use of soap, and scarcely ever wash their bodies; and even the interior wrappers of the ladies feet are allowed to remain, as long as they will hold together. They carry no pocket handkerchiefs; but wipe their dirty hands upon the sleeves of their gowns, and blow their noses into small pieces of paper, which their attendants have at hand for the purpose. They sleep at night, huddled up under a coverlid, nearly in the same clothes which they wear through the day; a circumstance which, together with their general filthiness, is productive of an abundant tribe of vermin, which the highest officers of the empire will not hesitate to call their attendants, even in public, to take from their necks, when they are troublesome; and which, when caught, they very composedly put between their teeth.

Natural dispositions.

The natural disposition of the Chinese people is mild, chearful, contented, and obliging; their exterior deportment uncommonly decent, and their manners extremely prepossessing. Their external behaviour, indeed, is so much an object of legislature, that there are few instances of abusive language, and still fewer of a quarrel proceeding to blows even among the populace; or if it should go so far, the tearing of each others clothes, and the plucking of each others hair, are generally the most serious consequences. The Chinese, indeed, are declared to be the most timid people on the face of the earth, entirely devoid of personal courage and presence of mind in cases of danger, and capable of being terrified almost into convulsions by the drawing of a sword, or the presenting of a pistol; yet it is said, that suicide by both sexes occurs more frequently among them, than in any other country.

Moral qualities.

The general character of the Chinese, in point of moral qualities, is represented by more recent observers, as a strange compound of pride and meanness, of affected gravity and real frivolity, of refined civility and gross indelicacy, of great apparent simplicity and openness in conversation, attended with a degree of art and cunning, of which an European has no conception. In the Tartar race, there is often a bluntness of manner, approaching almost to rudeness, a considerable frankness of disposition, and a greater adherence to truth and good sense in conversation; but in the real Chinese, there is always a studied complaisance, bordering upon servility, a ready acquiescence in every proposal, and an artful evasion of inconvenient promises, by the most sly pretences and plausible objections. They have no regard for the sacred nature of truth; but will assert or deny, without hesitation, whatever chances to suit the present purpose; and mendacity, in every shape, is affirmed to prevail throughout the whole nation, in a degree which is utterly unparalleled among any other existing race of beings. A natural attendant of this degrading habit, and perhaps also a consequence of the almost daily correction which they receive from the bamboo, is their general servility of mind, and entire want of all sense of shame. There is no principle of honour, or feeling of self-respect, in China; and the fear of detection, or rather of the pain of punishment consequent upon detection, is the great restraining principle and impelling motive both of high and low. A Chinese prince, or powerful mandarin, will commit extortion or oppression, whenever he can do it with impunity, and almost regard it as a matter of right attached to his station. A Chinese trader, or dealer of any description, will cheat and defraud whenever it is in his power, and even pique himself upon his skill in over-reaching, as a proof of his address, and a part of his profession. A Chinese peasant will pilfer and steal whatever is within his reach, whenever he can hope to escape detection; and the whole nation may be affirmed to have almost nothing in view, but their own self-interest and security. Their general character, in short, in point of morals, compared with the minute enforcement of duty by their penal laws, affords an irresistible proof of the utter incompetency of legislative provisions, without the aid of religious principle, to reach beyond the mere external conduct of individuals, or to produce any thing like real social virtue among human beings.

Mendacity.

Inhumanity.

They are extremely deficient even in common humanity and fellow feeling, to which they might rather have been expected to be generally predisposed by their natural timidity and personal sufferings. This cruel and unfeeling disposition appears, not only in the tyrannical proceedings and arbitrary infliction of punishment by men in office, but also in the daily conduct of equals and persons of the lower orders towards each other. The conduct of the soldiery towards those whom they have occasion to apprehend, is often brutal and inhuman in an extreme degree; of which a shocking instance is mentioned by M. De Guignes, that having laid hold of some robbers, whom they had no proper means of binding, they pierced their hands with bamboo reeds, and led them along in this agonising condition. Of the indifference, with which they can look upon human beings in situations of suffering and danger, without making the smallest attempt to afford relief, Mr Barrow relates the following specimen, which occurred during the progress of the British embassy down the Great Canal: Several persons, who had crowded to the brink of the canal, had posted themselves upon the high projecting stern of an old vessel, which broke down with their weight, and precipitated the whole groupe into the water, at the moment when the yachts of the embassy were passing. Though numbers of boats were sailing about the place, not one was observed to go to the assistance of the drowning creatures; but seemed even not to know that such an accident had happened, nor to pay the least attention to the shrieks of the boys, who were floating around upon pieces of the wreck.

Vindictive temper.

Licentiousness.

The Chinese are described also as extremely vindictive, and as indulging their spite, by watching for opportunities of accusing their adversaries to the mandarins; though it frequently happens, that the person accused, equally vigilant and crafty on his part, finds means, by the help of bribery, to make the evil rebound upon the head of his prosecutor. Hence are generated the most fatal feuds and lasting enmities, which frequently terminate by the parties setting fire to each others habitations. The wealthier and higher orders are much addicted to secret licentiousness, and fond of indelicate compositions. Prevented by the restraints of the sumptuary laws, and the dread of being pillaged by those who are in authority, from displaying their riches in expensive equipages and public amusements, they employ their wealth in the private pampering of their appetite, and the secret indulgence of voluptuous inclinations. As it is the law and custom of the country to marry in early life, this sensual disposition seldom appears in licentious intercourse between the sexes, except in the larger cities; but in a plurality of wives and concubines. They are moreover addicted to still more detestable modes of gratifying their passions, without seeming to attach any disgrace to such brutal practices; and many of the officers of state are publicly attended by handsome and well-dressed boys, in the character of their pipe-bearers.

Sobriety.

They are of all people the most exempt from the vice of drunkenness; and, at least, are extremely cautious of appearing before others in a state of intoxication. "I have never met with one of them," says De Guignes, "in this condition; and if merely a little touched with wine, so as to have a flushed and heated look, they appear embarrassed when noticed, and rarely, in such cases, shew themselves in the streets."

Vanity.

They are remarkably full of national vanity; and, in all transactions with foreigners, their self-importance is uniformly conspicuous. However notoriously they may be indebted, in articles of daily use, to the superior skill and science of Europeans, they obstinately persist in regarding all the nations upon the earth, as absolute barbarians in comparison with themselves; and it is said, that a Chinese merchant at Canton was actually subjected to a fine, for attempting to construct a vessel after the English model.

Ceremonious deportment.

Their exterior deportment to each other is so completely regulated by the court of ceremonies, and the omission of the smallest point of etiquette regarded so much in the light of a criminal offence, that even those persons, who are most intimately acquainted with each other, observe, upon meeting, the most stiff and formal behaviour, and perform the stated salutations with the most studied ceremony. Between those, who are members of the same family, and most nearly related to each other, a cold and ceremonious manner is uniformly observed. Every one lives retired and apart as it were from the rest; and nothing, like the easy conversation and unrestrained intercourse of European relatives, exists among them. Even at school, the constrained and ceremonious behaviour, which forms a principal part in the education of their children, prevents them from mingling freely with each other, subdues all their juvenile spirit, and restrains the playful disposition of their age; so that a Chinese youth of the higher class is completely inanimate, formal, and inactive, continually assuming the gravity of age, and carefully observing all the established rules of ceremony.

Filial piety.

Even the virtue of filial piety, in which they are represented as so pre-eminently exemplary, is rather a maxim of government, regulating the external conduct of the people, than a moral sentiment influencing the mind. Entire submission to the will of their parents is the first principle, with which they are impressed; and it is universally inculcated as a positive law, that a father has the same unlimited authority over the properties, persons, and lives of his children, as the emperor possesses over his people; but the whole system of domestic life in China is not considered as greatly calculated to render this civil submission the genuine result of dutiful affection.

It is only the prevailing character, which has been described in the preceding sketch of the Chinese nation; and it may naturally be supposed, that among so numerous a people there are not wanting (though in smaller proportion than in other countries,) individuals possessed of real humanity, integrity, and disinterested minds. Some of their officers of state, even, are represented by the gentlemen of the British embassy, as distinguished by a deportment at once dignified and engaging, and by the most unaffected kindness and condescension; and while, in public, they were under the necessity of assuming all the regulated ceremonious gravity of demeanour, they were in general, in private society, affable, familiar, talkative, and good humoured.

Many of the most unfavourable features in the Chinese character may justly be ascribed to the arbitrary nature of their government, and their peculiar state of society; living in continual fear, and daily suffering the most degrading chastisements, anxious to acquire wealth, which they find to be more powerful than justice or honour, yet obliged to conceal it when acquired; by such means, a people naturally quiet and passive, have been rendered habitually deceitful and unfeeling.

State of women in China.

One striking characteristic of Chinese manners, and of the low degree of civilization, which they have yet attained, is the degraded condition of the female sex, which is affirmed to be much more humiliating and oppressive than among the Greeks in ancient times, or the European nations during the dark ages. It is accounted a species of moral offence in a woman to be seen in the public streets; and when they do occasionally visit a relative or a friend, they must be conveyed to the house in a close chair; while those of them, who cannot command such a vehicle, are sometimes moved about in a covered wheel barrow. They are permitted, indeed, without incurring the charge of impropriety or vulgarity, to visit the temples on certain occasions, to enquire into their destinies; and barren wives, particularly, are encouraged to repair thither as often as possible, that, by rubbing the bellies of the little copper idols, they may conceive and bear children. Those of the lower class, are indeed, permitted to go abroad with greater freedom, but only that they may labour like slaves. They are often seen with an infant on their back toiling at the hardest tasks, while their husbands are sitting at their ease, or pursuing some amusement. They even perform the office of beasts of burden, and are at times employed in dragging the plough or the harrow, which their lazy helpmate holds with one hand, while he casts the seed into the ground with the other. Even in their state of domestic improvement, they possess no privileges or indulgencies; and are not permitted to sit at the same table, or in the same apartment with their husbands. The wives of tradesmen and mechanics generally employ themselves in weaving and embroidering silks, or in painting upon thin gauze the figures of insects, birds, and flowers. But, in the higher ranks, it is accounted a degrading office to handle the needle or the pencil; and the amount of their education consists in a little music and dancing. Utterly unqualified, therefore, to pursue any mental or improving occupation, they employ much of their time in listening to jugglers or fortune-tellers, and generally have recourse to the tobacco-pipe, as the chief expedient for beguiling their tedious hours.

Puny feet.

The most remarkable circumstance, respecting the women of China, is the custom of compressing their feet from their infancy, pushing forward the heel till it be entirely obliterated, and confining the toes with bandages beneath the sole, till they actually grow into the foot, of which they become as it were a part. The large toe is left free, and preserves its natural size; but still the foot makes scarcely any addition to its growth, except a kind of swelling above the instep near to the ankle bone; and the whole is generally so very diminutive, as to enter into a shoe of four inches in length, and an inch and a half in breadth. This practice prevails among all classes in China; and the smallness of the foot is reckoned the most essential point in female beauty, without which indeed they would be looked upon as utterly despicable. The origin of this strange and unnatural custom is wholly unknown; and is conjectured to have been only adopted during the lapse of a few centuries, as it is not noticed in the reports of the earliest travellers into China. It has been attributed to the jealousy of the men, as a method of keeping the females more at home; and is conceived to have been afterwards continued by the ladies themselves, as a mark of superior station. The Tartar women, however, have not conformed to this custom; but, on the contrary, have rather large feet, with wide square shoes; and both walk and ride abroad with greater freedom.

Marriages.

The women are invariably sold at marriage, and are not permitted to exercise any choice of their own. The bridegroom bargains with the parents or other relatives; and the highest bidder is commonly preferred. At the same time, he is not allowed to see his intended wife, till she arrive in procession at his gate, shut up in a close chair, of which he then receives the key; and, should it happen, upon his opening the door of the vehicle, that he is not pleased with his bargain, he is at liberty to return her to her friends, upon condition of forfeiting the purchase money. But the lady has no remedy or option, and must pass to the highest purchaser, or to the person whom her parents choose to prefer. Mutual affection, therefore, between the sexes may be considered as in a manner unknown in China; but every one hastens to procure a wife, because such is the law and custom of his country. He sets out to purchase his future partner, as he would look out for some necessary article of household furniture; and she continues on her side, to act nearly as inanimate and motionless a part, as if she were nothing else. She neither considers it as any indignity, nor expresses any feeling of jealousy, though a second or a third wife should be brought into the house; but is contented with presiding as the first female in the family, and with being called mother by all the children. Upon the death of the husband, the widow, if a person of rank, is honoured by preserving her state of widowhood; and it is very rarely the case, that she enters a second time into the married life. But, in the lower classes, the relations of the deceased generally dispose of the widow to another husband, that they may gain something by pocketing the price which she brings.

Marriage ceremony.

The marriage ceremony is sufficiently simple, and consists in little else than the procession of the bride to the gate of the bridegroom, and his reception of her into his house. The bargain, as has been mentioned, is concluded between the relations on each side; and the acceptance of the marriage presents is accounted a sufficient evidence and ratification of the contract. On the day appointed, the bride is conveyed in a close palanquin to her future residence, escorted by domestics and female slaves bearing presents from her family to her intended husband, preceded by musicians of different descriptions, and followed by her friends and relations. One of her nearest kindred carries the key of the palanquin, and commits it to the bridegroom upon reaching his house, who conducts his spouse to the presence of his parents, before whom they both prostrate themselves, in token of dutiful submission. Afterwards, the two parties partake together of food, and drink wine out of the same cup. The male attendants are entertained in one apartment, and the females in another; and on these occasions, the Chinese are often extremely extravagant, so as frequently to impoverish themselves during the rest of their lives, by the expences attending the marriages of their children. The wives continue their former retired life, seeing only their husbands or near relations, occupying themselves with the internal economy of their households, and devoting the greatest attention to the care of their children.

Birth and names of children.

The Chinese give great entertainments at the birth of their children to their friends, who on their parts offer congratulations and presents on the occasion. On the third day, the child is washed with great ceremony, when, among other meats and presents, the company eat painted eggs given by the grandmother. There is in every household a family name, which is never changed; and at the birth of a male, another name is given called *the little name*, which, however, the daughters never receive, but are distinguished simply by *first, second, third* placed before their family appellation. The *little names*, or names thus received at their birth, are used in signing letters; but no one addresses another by these designations. In entering upon their education, they receive from their teacher their *school name*, by which their master and school fellows always address them. Upon leaving school, they drop this name, and assume another at marriage, which they ever after retain, unless they obtain some honourable office, when they take an additional name, by which they are thenceforth addressed.

Infanticide.

A parent in China possesses the most absolute authority over his children; and, though he should occasion the death of a child by severity of punishment, is subjected only to the penalty of 100 blows, reduced in reality to forty. The practice of infanticide has long been regarded, as one of the deepest stigmas upon the character of the Chinese, and as the most unequivocal proof of their unfeeling dispositions. Though this barbarous and unnatural crime be not actually sanctioned by law in China, it is at least tolerated and overlooked. It is a part of the duty of the police at Pekin to go their rounds with carts at an early hour of the morning, to pick up the bodies of the infants, that have been thrown out into the streets, in the course of the night, and to carry them, without enquiry, to a common pit without the city-walls, into which they are said to be thrown promiscuously, whether living or dead. It has been calculated, that nearly 20,000, chiefly female infants, are annually collected in this manner throughout the empire; but, at the same time, it is admitted, that a great proportion of these have not been destroyed by their parents. As the law requires, that every corpse, whether young or old, must be carried to a place of burial, which is generally at a considerable distance from the city, and as funerals in China are attended with very heavy expences, many of the infants, found in the streets, are understood to have been dead born, or to have died in their early months, and to have been disposed of in this manner, as the cheapest mode of burial. M. De Guignes, however, positively denies the supposed frequency of infanticide among the Chinese, and strenuously maintains, that it does not happen in a greater number of instances, than might be conceived to arise in so vast an empire, from the extreme misery and poverty, to which the lower classes are often reduced by the dreadful famines which repeatedly occur. Some of his presumptive reasonings, however, against the fact, such as, that the Chinese account themselves dishonoured when they leave no family to perform their funeral rites, and to perpetuate their memory in the hall of ancestors; and that, in this view, they are often known to adopt the children of others when they have no offspring of their own; are by no means sufficiently conclusive on the point, as it is never contended, that a Chinese parent destroys *all his children*, but only those, for whom he thinks himself unable to provide. But what he affirms as facts, and advances upon his own personal observation, is more deserving of credit and consideration. There are in every city, he informs us, houses prepared to receive the children who are exposed; and thither all these, who are found alive, are carefully conveyed and brought up. "I have traversed China throughout its whole length. In travelling by water, I never saw an infant drowned. In my route by land, I have passed through the cities and villages early in the morning, and have been upon the roads at all hours of the day, and I never yet perceived one child exposed or dead." He affirms, farther, that the Chinese tenderly love their children; that the women are remarkably careful to preserve them from accidents; and that they testify all the usual distress of a mother, when their infants are in danger of perishing. "From all that I have said," he concludes, "I will not affirm, that infanticide does not take place in China; but I will contend, that it is not more common there, than in any other parts of the globe."

Slaves. In ancient times, there were no slaves in China, except those who were taken prisoners in war, or condemned to servitude by the laws. Afterwards, in times of famine, parents were frequently reduced to the necessity of selling their children; this practice, originating in the pressure of necessity, has continued to exist, and even become common, from mere motives of sordid avarice. It is chiefly female children, who are thus disposed of, and who are educated in music, dancing, and similar accomplishments, that they may be sold as concubines to the wealthier classes, or produce profit to their purchasers, from the wages of prostitution. Frequently, however, both male and female slaves are employed as domestics; the latter, generally accompanying the young women of the family when they marry, and the former being employed as labourers or artizans. Boys are purchased, also, by the players to be instructed in their art, and to recruit their number. A person may also sell himself as a slave, when he has no other means of succouring his father; and a young woman, who finds herself destitute, may, in like manner, be purchased with her own consent. The prisoners of war are the slaves of the emperor, and generally sent to labour on his lands in Tartary. Except in the case of those, who are sold by the sentence of the judges, and the concubines of a mandarin whose goods are confiscated, there are no public markets or sales of slaves in China; and the condition of persons of this class is very different from that of the negroes in the West India colonies, better protected by the laws, and treated rather as servants or even as children, than as beasts of burden.

Eunuchs. Eunuchs were formerly extremely numerous in China; and, as appears from the history of the empire, frequently exercised no small degree of political influence. At the Tartar conquest, they were reduced from ten thousand to one thousand, and afterwards to three hundred; but, since that period, they have again increased to about five or six thousand. They are employed chiefly in the imperial palaces or habitations of the grandees; where they perform the mere menial offices of sweeping the rooms, arranging the furniture, watching the gates, keeping the gardens, and serving the women. Those, who were observed about the emperor's palace at Pekin, were generally large and robust in their persons, but distinguished by an uncommon shrillness of voice. They have no beard, or soon lose it; and, though possessing plump countenances in youth, they become very ugly and wrinkled as they grow old. Many of them have wives, and adopted children, to whom they bequeath their property.

Mode of living. The mode of living among the lower orders in China is miserable in the extreme. Two or three jars, a few basons of coarse earthen ware, a large iron pot, a frying pan, and a portable stove, are the chief articles of furniture in their possession. They neither use tables nor chairs, but at meals all the family sit upon their heels round the large pot, with a bason in every one's hand. They take the rice from the pot with a spoon, and put it into the bason, which they hold in the left hand close to their mouths; and then, with two slender sticks, or porcupine quills, between the two first fingers of the right hand, they throw the food, with great expedition, into their mouths. Their food consists chiefly of boiled rice, millet, or some other grain, with the addition of onions or garlic, or some other vegetable, especially the Pe-tsai, a kind of insipid cabbage or beet, fried in oil, which is most esteemed when in a rancid state; and sometimes season their food with a wretched kind of ragout made of shrimps pickled in brine. They have little milk, no butter, cheese, or bread; and, unless in those places where fish abounds, a morsel of pork is the only animal food, which the poor can afford to taste, as a relish to their rice. They are little scrupulous, however, as to the articles of their diet; and rats, frogs, worms, and dogs, are all excellent food to a Chinese. The latter are reared and fed for the purpose, and are said to be neither unpleasant nor unwholesome. Those who were employed in the conveyance of the British embassy thankfully picked up the refuse of the provisions; and even boiled again the tea leaves which had been used. There is nothing so filthy, that those who ply in boats upon the river at Canton will not use as food; and the dead hogs, which are thrown over board, and which float when they begin to putrefy, are considered by these poor creatures as a most valuable prize, and often furnish occasion for serious contests. It is said, also, that the Chinese, when

Character and Manners.

they get on board of any foreign ship, are apt to give pepper, or some such article, which proves fatal to the hogs, that they may get them when dead; and it is certain, that multitudes of these animals die in the possession of Europeans, during their stay in China. Rice, however, is their great staff of life, and its name, Fan, occurs in almost every expression, which relates to food. A meal is named tche-fan, *to eat rice*; breakfast is called tsao-fan, or *morning rice*, and supper, ouan-fan, or *evening rice*. Their chief beverage is bad tea, boiled again and again, as long as the leaves will yield the smallest taste or tinge to the water; and this is taken without milk, or sugar, or any other ingredient whatever, except a little ginger in cold weather. The principal use of the tea is to purify the water, which, in that level country, is extremely impure, and which the Chinese never use till it has been boiled. They take little care, however, to procure it of a good quality, but make use always of the nearest pond, and trust to the effects of the tea to correct its impurities; and especially to the leaves, which are supposed to carry down the sediment to the bottom of the vessel. They make at least two regular meals in the day, one about 10 o'clock forenoon, and another about 4 or 5 in the afternoon; but it was observed, that they generally had their frying-pans on the fire by four o'clock in the morning, and were always cooking something or other for the belly.

The diet of the wealthy in China is as plentiful and sumptuous, as that of the lower classes is poor and meagre. The substantial articles of their ordinary meals are rice, pulse, pork, mutton, poultry, and fish. They seldom use beef, which is said, however, to be excellent at Wampoo; and their mutton also is good, but abounds only in the northern provinces. Ducks and game are in daily use; but the flesh of young pigs, which is said to be extremely light and wholesome in China, is the most common species of animal food at the tables of the higher orders. The Tartars make regular use of ass, and especially of horse-flesh, which is said to be sold at a higher rate in Canton than young pork. The flesh of hare and of the stag is much used at Pekin; and the most esteemed part of the latter animal is the tail, which is reserved for the table of the emperor, and which sometimes sells for 30 or 40 taels. It is said to have the taste of rancid tallow. The wealthy Chinese seek after the most nourishing and invigorating diet with great avidity, and at whatever price. The greatest delicacies are the most gelatinous substances, the paws of the bear, the fins of the shark, the sinewy parts of the stag and other animals, the nests of a particular species of swallow brought chiefly from Cambodia, and a kind of fucus or sea-plant. Of this last they make a very nourishing and refreshing jelly, which is mixed with sugar and orange juice. Their bread is made without yeast into small cakes, and is very light and white, but seldom sufficiently baked. They use a variety of vegetable substances in the form of pickles, particularly Pe-tsai, already mentioned, onions, ginger, and the young shoots of bamboo. They have a number of fruits also preserved by sugar, especially a preparation from the flour of beans, which is used sometimes in a liquid, and sometimes in a solid form, and which is represented as remarkably insipid. They are very fond of eating their fruit, after it has been cooled upon ice; and this luxury is so abundantly collected in the city of Pekin, that even the poorer classes are able to procure it. Their cookery is said to be sufficiently good, their soups and vermicelli particularly excellent, and their pastry, made from the flour of buck-wheat, unusually light, and as white as snow. Their dishes are chiefly in the form of stews of fish, fowl, and meat, sometimes separately, and sometimes promiscuously, mixed with various vegetables and sauces; and their drink at table is either tea or an ardent spirit distilled from millet or rice, which they always drink in a hot state, and which is said to resemble burnt brandy. They eat very plentifully, and rather voraciously, at meals; and throughout the day are constantly eating pastry and fruits, sipping spirituous liquors, smoking tobacco, or chewing betel and areca nut.

Character and Manners.

Prices of food.

The following are the prices of some of the principal articles of subsistence at Pekin, according to Mr Barrow.

Beef, per pound,	6d.
Mutton,	8d.
Pork,	8d.
Bread,	4d.
Rice,	1½d. or 2d.
Wheat flour,	2½d. or 3d.
Eggs, per dozen,	1s. 0d.
Fowls, each,	from 2s. to 3s.
Tea, per pound,	from 12s. to £1, 10s. and yet not so good as may be purchased in London at 6s. per pound.

Coals.

Coals, brought from the mountains of Tartary on the backs of dromedaries, are extremely dear, and are generally pounded, mixed with earth, and dried in the form of bricks, when they burn without flame, but yield a heat sufficiently strong for their small stoves.

Price of labour.

The price of labour in the same city is nearly one shilling per day to the best employed mechanics; but hired servants may be had at the rate of one ounce of silver, or 6s. 8d. per month, and sometimes merely for their subsistence.

Dress.

The clothing of the Chinese in ancient times, consisted of long and ample robes, with immense sleeves reaching to the ground, and a large quantity of hair gathered up under their caps. But they have been compelled to adopt the habits of their Tartar conquerors; and, like them also, they shave the hair from their heads, except a single tress or tuft, which they form into a long plaited queue, called Penzé. Many of the lowest class have scarcely any other clothing, than a single pair of cotton drawers, and straw shoes; but the dress of the majority consists of a jacket or frock of black or blue cotton, wide cotton drawers, straw hat and shoes, frequently without any covering for the legs, and sometimes with stockings of coarse cotton cloth. The better sort wear a kind of velvet cap on the head, of blue, black, or brown silk, a jacket of cotton cloth or European camblet, buttoned close round the neck, and folded across the breast, with sleeves remarkably wide; and frequently, instead of drawers, they have quilted petticoats and black sattin boots. In those provinces where silk is abundant, the people are clothed chiefly in that article, as all the Chinese proceed upon the principle of consuming their own immediate products, and of receiving as little as possible from other districts. The dress of the more wealthy consists of a number of garments. Besides a robe of thin coarse silk, nearest to the body, by way of a shirt, and a vest generally of the same stuff, with drawers, or quilted petticoats, they have commonly three and at least two upper garments. That which is next to the vest is without sleeves, but reaches nearly to the feet. The one above this is equally long, and has the sleeves very wide towards the shoulder, but narrower towards the wrist. The outer garment is not so long, reaching only to the calf of the leg, and has sleeves of a moderate width. These two upper robes resemble the

European night-gowns; and are fastened before with small round gilt buttons, which catch into little strings on the opposite side, so as to make the coats double upon the breast. Beneath their upper robe, they have a girdle fastened round the body, from which they suspend a watch, a knife, and a purse or pouch, generally containing a tobacco-box. They suffer their neck to remain uncovered during summer, but defend it from the cold in winter, by a collar of peltry, silk, or velvet. Their summer cap resembles an inverted funnel, lined with silk, with a tuft of red hair, or raw silk, on the top, hanging down on each side; but the winter bonnet is surrounded with a band of peltry. Instead of the bonnet, they frequently wear at home, a kind of under-cap of embroidered silk, sometimes ornamented with a pearl in the front. Their drawers, made of linen or silk, resemble generally those of Europeans. Their stockings are of quilted silk or nankeen, appearing above the boots, and bordered at the top with a ribband of silk or velvet. Their shoes come high upon the fore part of the ankle, and do not require to be tied. Their boots are made of black satin or leather, and do not reach higher than the calf of the leg. They are extremely wide, and are frequently made to serve the purpose of pockets, holding a fan, papers, &c. The soles are remarkably thick, composed of several folds of strong paper, covered with one of leather. In winter, the Chinese put on an immense load of clothes, sometimes, says Osbeck, to the number of thirteen or fourteen robes; and De Guignes declares, that he has seen them so stuffed out with clothing, that they could scarcely make their hands meet.

Dress of the women.

The dress of the women in the lower classes differs little from that of the men, consisting generally of a blue cotton frock reaching to the knee, a pair of wide trowsers or petticoats of red or yellow cloth, reaching to the calf of the leg, and there drawn very tight, to display the ankle and foot. The ankle is thick and swollen in proportion as the foot is diminutive; and is also bandaged with rollers of party-coloured cloth, ornamented with fringes and tassels; while the little shoe is almost covered with tinsel and tawdry appendages. The hair is screwed up close behind without taste, and folded into a ridge or knot across the crown of the head, where it is fastened by two bodkins of silver, brass, or iron, placed conspicuously behind, in the form of an oblique cross. A part of the hair of the unmarried women, however, is suffered to hang in short tresses round the head, and that of a very young girl is left still more dishevelled. The women of Pekin, particularly, adorn their hair with artificial flowers of a red, blue, or yellow colour, generally resembling asters; and those of the province of Kiang-nan wear a very peculiar cap of peltry or black satin, with a triangular peak in the front descending to the root of the nose, and adorned in the middle of the forehead with a crystal button. In most places they wear hats of different forms, commonly made of straw, completely surrounded with a fringe of blue cloth. They daub their face and neck with white paint; tinge the eyebrows black, in the form of an arch; and place a spot of deep vermilion, about the size of a wafer, in the centre of the lower lip, and at the point of the chin. They are generally of the middle size, and slender figure, with a short nose, long eyes, and little mouth; but their large teeth are uniformly yellow from the constant use of tobacco and betel, and their skin, from the early use of paint, soon acquires an ugly appearance. It is a piece of dress, both of men and women of rank, to suffer the nails of the left hand, especially of the little finger, to grow to an extraordinary length, in order to prove their gentility, and to distinguish them from labourers and mechanics. M. De Guignes saw a mandarin, whose nails were nearly six inches in length; and a physician, who had brought them to the length of nine, ten, and even twelve inches. The nails are thus kept extremely clear and transparent, and at night are carefully inclosed in bamboo cases. The Chinese dresses are generally cheap, chiefly formed of cotton, which grows in all the provinces, or of silk, which is in some places almost equally abundant; so that the complete clothing

	L.	s.	d.
Of a peasant costs about	0	15	0
Of a tradesman	3	0	0
Of a mandarin	10	0	0
But a mandarin's dress of ceremony	30	0	0
And those which are enriched with embroidery, and gold or silver tissue	200 or 300	0	0

Mode of living.

Entertainments.

The Chinese rise at a very early hour, and the streets in their cities are completely crowded at day-break. They retire to take their evening meal at five or six o'clock, and go to rest with the setting sun. They have few social meetings among themselves; and even the young people never assemble together for the purpose of athletic exercises, or exhilarating amusements. To play at games of chance is the chief object of an occasional company; and a kettle of rice, a cup of tea, or a pipe of tobacco, forms the only entertainment among the great body of the people. The higher classes give feasts and entertainments on particular occasions; but, in these, nothing approaching to conviviality or chearfulness appears; and almost every action, motion, or look, is regulated by the coldest forms of ceremony. The guests do not assemble around the same table, and partake of the same dishes; but a number of small tables are arranged in a line, each of which often accommodates only one person, generally two, and rarely more than three. This division of the company into small parties, does not produce any greater freedom in eating, drinking, or conversing; but every one must wait for a particular signal or ceremony, at every drop or morsel which he puts into his mouth. All eyes are constantly directed to the master of the feast, to observe his motions, and to eat or drink after his example. The repast begins with drinking to the health of the host; and the polite manner of paying this compliment is to lift the cup in both hands as high as the forehead, after lowering it again to carry it to the mouth, and after drinking deliberately to turn the cup downwards as a token of its being emptied. Every one's portion of the different dishes is measured out according to his rank, and placed on the table before him; and whatever remains after he has eaten, as well as the portion of any one who has been prevented from attending, is sent in procession to his house. Several changes of plates and dishes takes place, and two or three cups of wine or tea are drunk during the repast; and all the guests rise for a little, before the desert be served up, when each resumes his place. In this manner, four or five hours are commonly employed, during which period a play or dance is sometimes exhibited for the amusement of the company. Upon leaving the house, every one makes a small present in money to the domestics; and next day sends a note of thanks to the person, who gave the entertainment.*

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* "They swallow their food," says De Guignes, "in a gluttonous manner; and drink indiscriminately out of all the cups, without caring whether any one has used them before. Upon leaving the table, they prove, by every possible mode, that they have dined well; and even account it a point of politeness to give, in this manner, to the master of the house, marks of their *full* satisfaction."

Visits and salutations. The external expressions of civility and respect are exactly regulated and strictly inculcated by the laws of China. But it is the form, which they study, without either the ease of good breeding, or the sincerity of real kindness. Persons of all ranks prostrate themselves in the presence of the emperor, and address him in a set of phrases, which are appropriated to him alone. When any one presents a request to a mandarin of high rank, he bends the knee, inclines his head three times towards the ground, and, in this posture, communicates his wishes; but, should the petitioner be a person above the common order, he is generally desired to rise, and retiring to one side, he makes his speech in an upright position. In speaking, also, to persons of rank, it is a part of polite behaviour, to place the hand before the mouth, and to incline the body in a respectful manner. In ordinary cases, the mandarins avoid as much as possible to meet each other; but, when two of them chance to meet, the inferior leaves his palanquin, and makes a profound reverence to the other; or if they are of equal rank, they both remain in their chairs, and make a salute as they pass. When one of the lower order meets a mandarin, he does not presume to salute him; but quickly turns to one side, and places himself erect, with his head inclined, and his arms hanging by his sides. To the aged, to parents, and to elder brothers, particular respect is shewn; and they always occupy the most honourable place; which, among the Chinese, is the right hand, and, among the Tartars, the left. When two Chinese of equal rank salute each other, they bend themselves towards each other, join their hands, and repeat the words Tsin-tsin, or Tsin-leao, *I salute you*. On such occasions a common expression is hao-hao, *good, good*, or ya-fan, *have you eaten your rice*, a competent supply of which article is always a principal ingredient in the comfort of a Chinese; but to persons of superior station, the proper title of respect is Lau-yé *old sir*, or *old gentleman*, as age is always the chief object of reverence and esteem. When one Chinese wishes to pay a visit to another, he first sends in his compliments with his name contained in a billet of red paper folded like a screen, with a small triangular piece of gilt paper on the last leaf. These visiting cards or tickets, are of a certain size, colour, and degree of ornament, according to the rank of the parties; and the card of the viceroy of Pe-tche-lee to Lord Macartney, is said to have contained as much crimson-coloured paper, as would have covered the walls of a room of moderate size. If the person, visited, wishes to decline the visit, he returns the billet with a request, that his friend will not trouble himself to descend from his palanquin, and then sends to him a similar card; and the more hurry in dispatching it, the greater the respect. If, however, he is disposed to receive the visit, and if the visitor be of equal rank, then a multitude of civilities are interchanged. The great display of ceremony takes place in entering the gate, the stranger consenting only, after much entreaty, to pass through the middle gate, while the other enters by one of the side doors. Upon entering an apartment, a seat is offered, which the master of the house, at the same time, slightly wipes. When once seated, they keep themselves erect, with their hands upon their knees, their feet equally distant from the chair, and their whole appearance sedate and composed. Their conversation is remarkable for insipidity and sameness, turning chiefly upon the affairs of the neighbourhood, the injustice of the magistrates, the tricks and stratagems of the merchants and mechanics. Tea is always presented at these visits. The leaves are put into a porcelain cup, boiling water poured upon them, the cover put on, and the cup presented in a bason or copper server. The cup is lifted with both hands, and slowly emptied. If a present accompanies the visit, it is committed to the servants, and a note of the articles, of which it consists, accompanies the card. The master of the house examines the contents after the departure of his visitor; accepts the whole or a part; and, in the latter case, he writes in a note what he has retained, which he sends with the portion returned. Sometimes they merely send a list of the presents intended, when the person addressed marks the articles, which he is willing to accept, sends back the note, and then receives the objects specified. Even their letters are attended with similar formalities; every one consisting of nine leaves, beginning at the second; folded within an envelope, covered by a strip of red paper; then inclosed in a paper bag, which is sealed at the mouth, and upon which is written the name, quality, and residence of the person to whom it is sent.

Carriages. No person of any distinction can with propriety walk on foot, upon a visit or short journey; but must make use of a palanquin, a sedan-chair, a wheel-carriage, a horse, or mule. The palanquins of the mandarins are covered with green cloth, and the chairs of the ladies are closely shut. Among the carriages in use are large wheel-barrows, or small carts with one wheel, pushed along by one person; and these are sometimes provided with a sail, which appears to have very little effect, and to be attended with greater inconvenience than benefit. These wheel-barrows are used chiefly for carrying baggage, and also for conveying the women and children. In the latter case, they are commonly covered with a kind of mat to shelter the family; and, when heavily loaded, an ass is sometimes yoked in front, which answers better than the sail. Their travelling carts are narrow, clumsy, and ill constructed, with small wheels, without spokes. They resemble the hearses of Europe, though not above half their length; are without any seats, or springs, of which the Chinese appear to have no idea; and the only improvement, with a view to diminish the jolting, is to place the wheel well back, or to put a third wheel in the middle, between the two at the sides. They are always covered, generally lined with blue cloth, and sometimes furnished with black cushions. They are commonly open in front, with a square window at each side; but sometimes they are shut before, and have the door at the side. The driver sits at the entrance in front; and they have only one horse, even in some of a considerable size. When the Chinese ride on horseback, they use commonly wooden saddles, and a simple cord by way of bridle. Instead of horses, they prefer mules, because their step is more sure, and their motion more easy, because they are capable also of subsisting upon less nourishment, and of enduring greater fatigue. They are not fond of riding at great speed, but rather set out early, and travel slowly. In the northern districts, numbers of dromedaries are used as beasts of burden, which are remarkably gentle, and generally follow one another in files, a driver merely leading the foremost with a cord.

Games and amusements. The Chinese, of all ranks, are passionately fond of gaming; and whenever they come together, whatever be the occasion, they seldom separate without a trial of their good fortune. For such opportunities, a Chinese is always provided with a pack of cards, or a pair of dice in his pocket. The former are long and narrow, smaller in size, but more in number than those of Europe. The latter are exactly similar to ours, and are frequently carried in a cavity, made for the purpose in the handles of their knives. When the party are not provided with either of these articles, they have recourse to their fingers, with which they play a game named Tsoi-moi, and which is extremely common among the lower classes. At this game the closed hand is counted nothing, and each finger, when elevated, is reckoned one. The players sit opposite to each other; one of them names a particular number, suppose six, and holds up as many fingers as he thinks proper, suppose two; to which his opponent replies by raising four fingers, the number required, together with the two fingers of the first player, to complete the number announced. At this game, they play remarkably quick, and keep bawling at a great rate. It is frequently introduced among the middle classes of the community, at their entertainments; and the person who loses, or mistakes the number, is obliged to drink a cup of wine or spirits,—a species of forfeit which in some countries might incline the player to lose, and which even the Chinese sometimes continue till they become unable to distinguish the fingers; but in these cases they generally remain in their place, that they may not be seen in this flustered state. Persons of a better station play also at a kind of chess, a game which is much esteemed in China, and in which the number of pieces are the same as what are used in Europe, but both the names and moves are considerably different.

Chinese chess.

The board contains 62 squares; but the pieces are placed at the intersecting points, and not within the spaces formed by the lines. These pieces are, a general, placed in the middle of the line next to each player, having on each hand an adjutant, an elephant, a knight, and a chariot. In the third line, and before each of the knights, is placed a bombardier; and in the fourth line are five soldiers, one in the front of each chariot and of each elephant, and the fifth in the front of the general. The general never leaves the points of intersection formed by the four squares immediately adjacent to his place; the adjutants move like our bishops; the knights also like ours; the chariots and bombardiers like our castles, except that the latter take a piece only when there is another before it; and the soldiers move like our pawns, straight forwards, taking, however, only in that direction, and not in an oblique manner. They play also at domino, and a species of draughts, in which there are 360 squares, with a number of men on each side; and in which the game consists in shutting up the adversary, by occupying the greater part of the spaces. Contrary to the assertion of the French missionaries, the spirit of gaming, especially at games of chance, is so prevalent, that almost every bye-corner in the streets is occupied by a groupe of gamblers; who often continue whole days at play, and sometimes carry their infatuation to such a height, as to stake their wives and children upon a throw of the dice. The higher classes are passionately addicted to the barbarous amusement of cock-fighting, or rather quail-fighting; and have even employed for their sport in a similar manner, a species of locusts, which fight with such ferocity, as seldom to quit their hold of each other, without bringing away a limb in their gripe. These little insects are fed with great care, each in a separate bamboo cage; and it is said, that, during the summer months, scarcely a boy is to be seen without his cage and grasshoppers. Dancing is rather a spectacle or pantomime in China, than an exercise of individuals for their own amusement; and consists merely in a set of marches and evolutions, sufficiently whimsical and wearysome. They have frequently plays represented, even at their private entertainments; and a stage is prepared in an instant, with merely a table and a few chairs placed in front of a large hanging, in which are two openings for the passage of the actors. The mandarins have generally rooms for the purpose; and the people often fit up parts of the pagodas as theatres, or erect them across the streets, from one corner house to the other, where the multitude spend whole days in witnessing the exhibitions.

Funerals.

One of the principal and uniform cares of a Chinese, during life, is to preserve his body from being maimed, and to die in possession of all the members, which he received from nature. Some of them, it is said, carry this precaution to such a length, as to preserve all their hair and nails, which have been cut, that they may be carried with them to the grave. His next object is to provide a proper burying ground for himself and his family; and, after ascertaining from a Bonze, or some oracular temple, the most fortunate situation, he spares no expence in the purchase. The burying grounds are always situated at some distance from the towns or villages, generally upon an eminence; and, as one corpse is never interred in the same grave, where another has been laid, at least as long as the smallest vestige of the former remains; these burying places occupy an immense extent of ground, planted with cypress or weeping willows, and sometimes provided with a pagoda and idol images.*

The funeral rites are attended with enormous expence in China; and the most showy articles, to be found for sale in the large cities, are coffins for the dead. They are made of planks, from three to six inches in thickness, very closely joined; raised like a trunk on the top, and generally convex, also, at the two ends. They are sometimes made of the more precious kinds of wood, very richly ornamented, and cost from 300 to 600 dollars; while that of a person in ordinary wealthy circumstances is seldom procured for less than from 10 to 15 or 20. It is a common practice for individuals to purchase their coffins during their lives; and it is frequently the son who presents one to his father, which is always the more highly valued, and shewn with greater complacency to every visitor, in proportion to its magnificence. When brought forth for use, a layer of lime is put into the bottom; the body deposited in full dress, with a cushion under the head; the vacant spaces completely filled with lime and cotton; and the lid then fastened down with the utmost exactness. The whole coffin is generally pitched within and without, sometimes covered with varnish, and whitened externally. In this state they often remain in the houses a considerable time, without the smallest odour being perceived; and, while the body of a parent is thus kept uninterred, during the period of mourning, his children, go every day to weep at the side of the coffin. In ordinary cases the corpse is laid in a room hung with white cloth, with a covering of the same colour thrown over the coffin, and a table placed before it, with candles of perfumed materials. In this situation it remains several days in the house previous to interment; and all, who come to show their respect to the memory of the deceased, are entertained by some of the relatives with tea and other refreshments. On the day of the funeral, after the relations and friends are assembled, the procession is opened by musicians, who are followed by several persons carrying the figures of various animals, the insignia of the rank of the deceased, small pagodas, parasols, white and blue flags, with vessels of perfumes. Next walk a party of Bonzes, immediately before the coffin, which is carried by 4, 8, or even 20 men upon a litter, which is sometimes surmounted by a canopy. Behind the body are the children and near relations, with robes of coarse linen over their clothes, and caps of the same stuff. The eldest son walks with his body bent forwards, leaning upon a staff, and is generally supported by two friends, one on each side, who prevent his repeated attempts to tear his hair and his face. These are followed by the friends and domestics; and last of all, at a little distance behind, appear the women, on foot, or in palanquins, with dishevelled hair and broad white fillets round their temples, dressed also in the same coarse linen as the men, and bursting at intervals, as with one consent, into lamentations and tears. These processions, in the case of persons of distinction, sometimes extend more than a mile; and whenever they approach a bridge, or temple, a halt is made, a few images of tin-foil are burned, a parcel of crackers are fired, and a flourish is sounded by the gongs and other musical instruments. If the deceased has not previously fixed upon the precise spot for his grave, the relations consult the Bonzes as to the place, which is most likely to prove agreeable to his manes, and which is generally a dry, well-aired, and pleasantly situated spot. The better that all these matters are arranged, the more does it gratify the deceased, and the more do his surviving relations prosper. So much, in their opinion, depends upon the proper situation, especially of a father's grave, that when a family becomes unfortunate, it is not uncommon for them to raise the dead body, and to seek a more agreeable spot, that, if possible, the malignity of their destiny may thus be changed. When the coffin is entirely covered with earth, libations are poured out; perfumed candles and paper flags placed around and upon the tomb; and the figures of men, clothes, and horses, all cut in paper, are burned upon the spot, in the firm persuasion, that the objects, thereby represented, will attend the deceased into the other world. This last mentioned ceremony is supposed to have been substituted in place of a barbarous custom formerly practised, especially among the Mantchoo Tartars, of sacrificing the horses, slaves, and concubines of deceased princes and mandarins at their graves; and it is certain, that so late as the year 1661, at the death of one of the wives of the Emperor Shun-tchee, thirty persons, and an immense quantity of gold, silver, silks, and articles of furniture, were burned along with the body. After the ceremonies are finished, the company rest themselves in tents erected at a little distance from the grave, where they pronounce the *eulogium* of the deceased, and partake of the meats offered to his memory; and then returning to the grave, prostrate themselves before it, and exchange salutations with the chief mourner, in profound silence. The period of mourning is fixed by law, according to the degree of relationship; and the time appointed for a father or mother is three years, which is reduced to 29 months, during which period the mourner can hold no public office, unless the Emperor expressly requires the continuance of his services. During the earlier months of the time of mourning, the dress is made of a coarse reddish cloth made of hemp, with a cap of the same, and a cord round the middle. During the second period, the robe, cap, and shoes are white. During the third, the dress may be of silk, but the shoes must still be white or blue. Both during the period of mourning, and long after it is expired, the children and other near relations frequently go to weep at the graves of their deceased parents. Every year, at the third moon, they regularly visit the abodes of the dead to repair the tombs, and to renew, in part, the ceremonies of interment; and particularly, in the spring season, the whole community assembles in the hall of ancestors, to perform similar rites in honour of their respective departed fore-fathers. In this hall is placed a tablet about five or six inches long, called Shin-tchoo, or *abode of the spirit*, on which is inscribed the name and rank of the deceased, with the year, month, or day of his birth and his death. Besides making prostrations and presenting offerings before this tablet, the relations prepare a piece of silk, about two yards in length, upon which they write the same inscription as upon the tablet; and believe, that, by this ceremony, they invite the spirit of the deceased to take up his abode in their habitations.

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* See under the head of Architecture in this article, some account of the Chinese cemeteries.

NATURAL HISTORY.

The empire of China, which is so very extensive, may naturally be supposed to exhibit considerable varieties of soil and climate. The prevailing qualities of each in the several provinces, have already been noticed in the introductory part of this article; and it is only the general features of the country, which remain to be mentioned.

Climate.

The temperature of the atmosphere is, generally speaking, rather warm than cold, and is much affected by the direction of the winds, which almost make the circle of the compass during the course of the year. They blow from the north, and north east, in October, November, December, January, February, and March, and during this period the weather is rather cold; from east and south-east, in April and May, when it is cool; from the south and south-west in June and July, when it is hot; and from the west in August and September, when it is extremely sultry and oppressive. The coldest months are November, December, and January, and the hottest, July, August and September. Ice is sometimes found at Canton during the winter, of the thickness of a dollar; but snow is never, or at least very rarely, seen in that city. The air is generally dry during the north, moist during the south, and clear during the west winds. The north winds are the most violent, and the south the most feeble; those from the east are strong, and those from the south and south-west are more moderate. It is always calm weather when the winds are about to change, and the storms take place commonly in July, August or September. These hurricanes, called Tay-fun, continue for eighteen or twenty hours, coming in sudden gusts accompanied with rain, always preceded by the sinking of the barometer, and generally ceasing whenever the thunder breaks. The barometer varies less in China than in Europe, seldom rising higher than 28 inches and 8 lines, or falling lower than 27 inches and 10 lines.

Diseases.

The climate of China appears to be highly salubrious, if a judgment may be formed from the small number of diseases, which seem to prevail among the inhabitants. They profess to be free from stone, gout, and gravel complaints; and are seldom affected with cutaneous disorders,—an exemption, which they ascribe to the use of tea. Epidemic fevers, however, are frequently generated in their crowded cities, and destroy great numbers of the lower classes. Many of the Chinese, also, are affected with a species of leprosy, which frequently occasions their fingers and toes to drop off; but it does not appear to be so highly infectious as the real leprosy; and no restriction is put upon those, who are labouring under the disease. It is conjectured to be merely the effects of an inveterate venereal lues spread through the system. The small-pox have prevailed in China for a considerable time; but, according to some, only since the tenth century, when they were introduced into the country by some Mahometan traders. Their physicians pretend to distinguish forty different kinds of small-pox; and when a favourable sort appears, they endeavour to propagate the disease from it, not by proper inoculation, *i. e.* by introducing the matter by incision; but by inserting into the nostril a little cotton wool dipped in the virus, or by putting on the clothes of the infected. But by the introduction of vaccination by Sir G. Staunton and Mr Pearson into Canton, and the progress which the practice is making throughout the empire, they have the prospect of being delivered from the ravages of that dreadful disorder more effectually, than by the most improved system of variolous inoculation. The venereal disease is not common in China, but chiefly exists in their sea ports, and is therefore called by the Chinese, the Canton ulcer. Even those, who are infested with the distemper, do not appear to suffer so much from its effects as persons in Europe; but generally find relief, and often a complete remedy, by the use of diluents and sudorifics. Sore eyes and total blindness are affirmed to prevail very generally, especially among the lower classes; and has been ascribed to a variety of causes; to their low, crowded, and smoky habitations; to the noxious effluvia from the dirt and offals, generally collected near the houses; to the custom of washing the face, even in the hottest days of summer, with warm water; to the uniform use of rice, or at least to the steams of the dishes filled with it and other stews; to the strong varnish used by those who work in japanning; to the smoke of their perfumed shops and candles morning and evening; to the practice of eating and drinking every thing extremely hot; to the blowing of the north winds over the snowy mountains of Tartary; and to the mode of inoculating for the small-pox, by inserting the virus into the nose. Osbeck, however, affirms, that the Chinese declared the greater part of the blind among them to have been born in that condition; and he himself denies, that they were so numerous, at least at Canton, as has been represented.

Soil. The general character of the soil is a loose sand, free from stones, of a reddish or yellowish colour, sometimes upon a bottom of clay, and furnishing, in certain places, a vegetative mould to the depth of five or six feet.

Earthquakes. Slight and short earthquakes are said to be frequently felt in all the provinces; but there is no appearance of volcanic productions in the country, though various substances of that description are found in some of the islands along the western and southern coasts.

Mineralogy. Several of the mountains contain mines of quicksilver, tin, copper, iron, silver, and gold; but it has been the general policy of the government to discourage the working of these ores. They are not, however, entirely neglected, and are all the property of the Emperor. The copper mines in the provinces of Yun-nan and Koeitcheoo are very productive; and the former yield a kind of white copper resembling silver, which is rendered softer and less brittle by being mixed with zinc or some similar metal. The Lolos procure, also, from the mines in Yunnan, both gold and silver in an impure state, which are well refined by the Chinese artists. Great part of the gold in China, however, is procured from the sand of the rivers and torrents, which flow from the western mountains, especially those of Setchuen and Yunnan. This gold is chiefly employed in gilding, and in making trinkets, and similar articles of merchandise. Iron, lead, and tin, are extremely abundant, and sold at a moderate price, in every quarter of the empire. Small rubies are also found in Yunnan, but the greater part of the precious stones, sold in this province, are supposed to be procured from the neighbouring kingdoms of Ava and Laos. In the western districts, lapis lazuli, resembling that of Europe, is found in sufficient abundance; and beautiful rock crystals, which are cut into buttons, seals, and other trinkets, are procured from the province of Fokien. There are numerous collieries throughout the empire, especially in the vicinity of Canton, which are worked by driving levels into the sides of the mountains; and the coal which they yield is immediately transported to the potteries in Kiang-see and Quan-tong. The coal is generally charred in large pits before being used, or pounded and mixed with earth, and formed into small bricks for heating the stoves used in cookery. In the same mountains, also, are very extensive stone quarries, from which are cut large blocks for sepulchral monuments, for the arches of bridges, for paving the streets, &c. These masses are cut by applying the saw to the upper surface, and working vertically to the depth required; and each stone is fashioned to the proper shape and size, before being removed from the parent bed. Between Canton and the first pagoda on the banks of the river, there is a succession of old quarries, which have been so regularly cut in this way, as to have the appearance of buildings in ruin. Marble quarries are not uncommon, particularly in Fokien; but the Chinese are said to be unacquainted with the best modes of working them. Sonorous stones, of which musical instruments are made, are found in the rivers and torrents, which flow along the bottom of the mountains in Yunnan, Koeitcheoo, and Shensee. They are of very different degrees of density and gravity; but the most esteemed is that called Yu, to which the Chinese authors ascribe a number of qualities, of which the modern specimens afford no proof. The most esteemed of these are of a whey colour, and the next in value are of the colours of bright blue, azure, indigo, citron-yellow, orange, logwood-red, pale-green, sea-green, deep-green, cinder-grey, &c. The largest of them, ever seen by the missionaries in the Imperial palaces, were two and a half or three feet in length, and one and a half in breadth. The best are so extremely hard, that, when cut and polished, the best tempered steel slides upon their surface, without making any impression; and so heavy, that four men, it is affirmed, could scarcely move a single block of two and a half feet in length, and half a foot in breadth. Another species, called the ox-fat-stone, resembling agate, is more common; but is inferior to the yu in hardness, weight, and tone, and is not found in pieces sufficiently large for making musical instruments. There is a third kind, resembling alabaster, which yields a hard metallic sound; and a fourth species, like marble, apparently vitrified in some parts, and seeming to be composed of talc and crystal. One of the Chinese musical stones, which was analysed by the Duke de Chaulnes, neither attracted the magnet, nor discovered any phosphoric quality, but shewed a number of small particles resembling pyrites; produced a strong effervescence when dissolved in acids; and yielded much the same results as black marble, several kinds of which have been found to be highly sonorous.

Mountains. The principal mountainous tracts in China are in the northern and western provinces. Many of those in the latter districts are cultivated, but those in the former direction are rocky and barren. In the provinces of Shensee and Ho-nan, towards the centre of the empire, and in those of Quantong and Fokien in the south, the mountains are generally covered with lofty forests, chiefly of pine trees, which supply excellent timber for ship building, and from which the emperor causes enormous trunks to be transported to great distances, to be employed in the construction of his palaces, and other public edifices. Those in the neighbourhood of Canton are remarkably wild and rugged; but those, which appear along the southern coast of the gulf of Pe-tche lee, which are nearly of the same size and form, and entirely detached from each other, are smooth regular cones, as if they had been fashioned by the the hand of art. Most of the mountains, which were observed by the gentlemen of the British embassy, were of primeval granite, a few of sandstone, and the smaller hills, of lime-stone or coarse gray marble. There is rather a curious mountain between the provinces of Quantong and Kiang-see, called Melin, to the top of which there is a paved road in a zig-zag direction; and at the top is a narrow pass cut through a granite rock, in the middle of which is a military post with two old pieces of cannon. The base of this hill is covered with cottages, and the view from its summit is said to present two very opposite prospects, one rich and beautiful towards the south, and another dreary and barren towards the northern regions. Of their mountains, the Chinese relate many wonderful stories; such as, that there are some of them, which render those who retire to live upon them immortal; that one in Shen-see is the exact figure of a large cock, and sometimes crows so loud, as to be heard at the distance of three leagues; that another in Fokien trembles before a storm, moving backwards and forwards like a tree agitated by the wind; that another in Shen-see vomits forth flames, rain, and wind, whenever any one beats a drum, or plays upon any musical instrument in its neighbourhood; and that one in Fokien represents a colossal figure of the god Fo, which is so immensely gigantic, that each of the eyes is several miles in circumference, and the nose several miles in extent.

Lakes.

Lakes and swamps are extremely numerous in China, and are supposed to cover nearly one-fourth part of the country. The principal lakes are two in Kiangnan, the Hong-tse and Kao-yeoo; the Tai-hoo, which is partly in the same province; the Tong-ting-hoo, in the province of Hoo-quang, said to be more than 80 leagues in circumference; and the Poyang-hoo in Kiang-see, which is subject to tempests like the sea, and, including the surrounding marshes, is nearly 100 leagues in length. It lies remarkably low, and is considered as the sink of China. Rivers flow into it in all directions, four of which are of a very considerable size; and the country around it has, for many miles, the appearance of a uniform marsh, without one visible sign of cultivation, and without any inhabitants but a few miserable fishermen, whose huts and boats appear here and there upon the brinks of the smaller pools. Its vicinity, in short, is described as one of the most desolate and dreary regions in nature; and, by such an extent of waters and swampy grounds, the temperature of the surrounding atmosphere is reduced a number of degrees below that of the adjacent country.

Rivers.

Hoangho, or Yellow River.

All the great rivers of China fall from the high lands of Tartary on the north of Thibet, and cross the plains of the country in their descent to the sea from west to east. The two principal rivers are the Hoangho, or *Yellow River*, so called from the yellow colour, imparted to its waters by the mud or clay, which it washes down from the mountains in the rainy seasons; takes its rise under the 35° of north latitude, in the mountains of Kokonor in Tartary; passes through a considerable part of that country along the outside of the Great Wall; enters China between the provinces of Shen-see and Shan-see; traverses the province of Honan, and a part of Kiangnan; and, after a course of 600 or 700 leagues, falls into the Eastern Sea, not far from the mouth of the Kiang. Its stream is extremely rapid, and frequently overflows its banks, along which in many places are raised dykes of great length, composed of alternate beds of clay and straw, while most of the cities in the vicinity of its channel are surrounded with strong ramparts of earth faced with turf. In these works immense sums of money have been expended; and the emperor Kang-hee declares in his last will, that 3,000,000 ounces of silver, or £1,000,000 sterling, were annually employed to restrain this river within its banks. But notwithstanding all these precautions, the low country through which it flows is so liable to inundations, that the Chinese affirm its overflowings to have been more destructive than the united effects of war, pestilence, and famine. Its breadth, at the distance of 25 leagues from its mouth, is not less than 500 or 600 toises; but its waters are so extremely shallow, that it is scarcely navigable to any extent. It washes down such an enormous mass of mud with its waters, that the quantity was found, by experiment, to equal two millions of solid feet in one hour; and this slimy matter, after entering the Yellow Sea, being carried by a strong wind to the Gulf of Pe-tche-lee, where the stillness of the water allows it to subside, forms innumerable islands and sand-banks in that remarkably shallow bay.

Yang-tse-Kiang, or Son of the Sea.

The next great river of China, is the Yang-tse-kiang, or *Son of the Sea*, which has its source in the country of the Too-fan, about 33° of north latitude; traverses a part of the provinces of Yan-nan, Se-tchuen, Hoo quang, and Kiang-nan, through a course of more than 700 leagues; and falls into the Eastern sea in the 32° of north latitude, opposite to the island of Tson-ming, which is supposed to have been formed by the soil carried down by the stream, and which is not less than 20 leagues in length by six in breadth. This river is less rapid, but much deeper than the Hoang-ho. At the distance of 30 leagues from its mouth, it is fully a league in breadth; and, at the distance of 140, it is not less than half a league wide. It forms numerous islands in its course, which it is continually sweeping away, and replacing with others; and, from the reeds which grow upon these accumulations of soil, to the height of ten or twelve feet, the cities along its banks are abundantly provided with fuel. In consequence of these shifting banks, and the great rapidity of its stream, its navigation is very dangerous, and daily proves fatal to numbers of vessels.

Smaller rivers.

Some of the smaller rivers are, the Pei-ho, which flows through the province of Pe-tche-lee, and which has remarkably low, sandy banks; the Eu-ho, or *precious river*, called also Yung-leang-ho, *the river upon which grain is transported*, flows from the westward, and forms a confluence with the Pei-ho at Tien-seng; the Pei-kiang-ho, which rises in the mountain of Melin between the provinces of Kian-see and Quan-tong, flows by the port of Canton, and is familiarly known in Europe by the name of *Bocca Tigris;* and the Kan-kiang-ho, in the province of Kiang-see, in the course of which is a remarkable cataract called Shee-pa-tan, or the *eighteen cataracts*, a succession of torrents formed by ledges of rock running across the bed of the river. It is a place greatly dreaded by the Chinese, on account of the multitude of boats which are dashed to pieces in the passage; and yet it is represented as by no means so dangerous as the fall at London bridge, about the time of half tide. But the Chinese display neither dexterity nor courage in the management of their vessels in such situations of danger; and, instead of exerting their own attention and activity, are apt to leave the boat to itself, while they set to the burning of sandal wood matches, and the sounding of their gongs, to appease the river-deity. The country around this cataract is described as peculiarly beautiful, the stream itself transparent, and abounding in fish, its bold rocky banks fringed with wood, and the mountains covered with the larch fir, and a fine plant called *camelia Japonica*, resembling the tea shrub.

China produces the greater part of the fruits, which

Vegetable productions.

Fruits.

are known in Europe, with several others peculiar to itself; but, except the practice of ingrafting, they employ few artificial means for improving the quality of their fruits, and suffer them to grow almost in a wild state. Hence, except the grapes and pomegranates, the fruits of China are very inferior in flavour to those of European growth. Their *apples* are soft and spongy; their *pears* of an immense size, † sometimes excellent, but commonly of a remarkably austere taste; their *cherries*, universally indifferent; but their *peaches* generally good, especially one kind of a flat shape. They have various kinds of *apricots*, which are in general detestable; but one kind, which grows wild on the waste soils and most unfavourable situations, yields, from its kernels, an excellent oil for lamps, while the stones are employed as fuel in the small stoves. Apricots are frequently preserved both in a dry and liquid state, and sometimes the juice only is pressed out, boiled into a pretty thick consistency, and formed into a kind of lozenges, which may be kept for any length of time, and which, when dissolved in water, make a very cooling and refreshing beverage. *Grapes* are very abundant, but it is said that the government prohibits the making of wine; but the fact is, that the Chinese grape is not capable of producing it; and it was with great difficulty, that the missionaries at Pekin succeeded in their experiments for that purpose. The *olives* are of different kinds, but none of them seem to be cultivated for the purpose of making oil. It is affirmed, that, before gathering the fruit, a hole is bored in the trunk of the tree, filled with salt, and closely covered up, and that, at the end of a few days, after this operation, the olives drop off. *Oranges* are found in great variety in China, but the most esteemed is of a small size, smooth soft skin, and a reddish yellow colour. Another kind, of a large size, is of a firmer texture, not easily peeled, nor capable of having the pulp divided into separate parts; but is of a wholesome quality, and, after being softened at the fire and mixed with sugar, is frequently given to the sick. *Lemons* and *citrons* are also common, some of which are large like the shaddock; and a smaller kind, resembling a walnut, is cultivated with particular attention for culinary uses. There are not wanting mangoes, bananas, pine-apples, tamarinds, figs, almonds, and other fruits sufficiently known; and there are many again peculiar to the country, of which the most celebrated are,—the Lee-tchee, resembling a date, which the Chinese frequently dry in the rind, using it in their tea, to which it communicates a slight acid taste, and which the missionaries have represented as a most delicious fruit, but which is said to have the taste of an insipid onion, and to be of a very heating nature, covering the skin with pustules, when eaten to excess.—The Long-yan, or dragon's eye, which has a tart juicy taste like the last mentioned, but more agreeable and wholesome, at least to Europeans.—The Hoang-pee, which has a sourish taste, like that of gooseberries, when scarcely ripe.—The Tcheetse, which resembles a fig, about the size of an ordinary apple, and which, when dried and flattened, are called Tchee-ping, and are then equal to the best figs of Europe.—The Lin-kio, a species of water chesnut, of a cooling and agreeable taste, sometimes sold like filberts, in a green state, sometimes dried, powdered, and made into soup, and sometimes baked in the oven with sugar and honey. In order to propagate the plant, it is sufficient to throw the seeds, about the end of autumn, into the shallowest places of ponds or rivers, in a south exposure.—The Pee-tsee, another water chesnut, which grows only in the southern provinces, wholesome and cooling, and much used by the sick. Its leaves are long like those of the bulrush, and hollow like the stalk of the onion. Its fruit is found in a capsule formed by the root, in which it is inclosed, like a chesnut within its husk, and from which it may be extracted without injuring the plant.—Belvidere, or Chenopodium, found chiefly in a wild state, the leaves of which, resembling those of flax, are eaten as sallad with salt and vinegar, or baked with meat, to which they communicate an agreeable flavour; its principal stalk and root are also dried and baked; sometimes reduced to a kind of flour, which is made into small loaves, and used by the poorer classes in seasons of scarcity.—Hemp is often cultivated in the Chinese gardens, not for the purpose of being manufactured into cloth; but for the sake of its leaves and seeds, which are mixed with tobacco for smoking.

Pot-herbs.

Pe-tsai.

Lien-hoa, or water lily.

In their gardens are tobacco, sallads, leeks, onions, garlic, spinage, carrots, turnips, raddishes, celery, mustard, beans, calavances, pepper, ginger, pumpkins, cucumbers, gourds, musk, and water-melons, and many of the common European pot-herbs, of which they procured the seeds from the Portuguese. But their most common pot-herb is the Pe-tsai, or white herb, a kind of brassica or cale, which the Chinese prefer to all other vegetables, and with which large fields are often covered. It grows to the height of two feet; and a single plant will often weigh from ten to fifteen pounds. It has an insipid taste, not unlike to that of cos-lettuce. It is sometimes half-boiled and dried, or salted in brine, and prepared something in the manner of the sour krout of the Germans. But one of the most abundant, most curious, and most generally useful of these plants is the Lien-hoa or Lien-wha, the water lily of China, formerly known to botanists under the name of *Nymphæa Nebumbo*, but now considered as a new genus, and distinguished by the appellation of *Nelumbium*. The leaves are round, broad, and large, thick and fibrous, and indented towards the middle; some of them floating on the surface of the water, and others rising upon long stems. The root, which is sometimes 12 or 15 feet in length, and of the thickness of a man's arm, of a pale yellow colour internally, but milk white in its external surface, creeps along the bottom of the lakes, attaching itself to the mud or earth, by a multitude of small filaments. The flowers are composed of several petals, disposed in such a manner, as to resemble large tulips when half blown; and from the middle of the flower rises a conical pistil, round and spongy, divided into cells, which are filled with oblong seeds, covered with a husk like the acorn, and composed of two white lobes. It grows spontaneously in almost every lake and morass, from the middle of Tartary in the north, to the province of Canton in the south; and yet it is with the utmost difficulty, that it can be preserved by artificial means in Europe, in places where the climate is neither so cold nor so warm as many parts of China, where it vegetates naturally and luxuriantly. It is said to form one of the ingredients, which compose their liquor of immortality, and has been celebrated by their poets of every period, as an emblem of creative power. The leaves of the succeeding plant are found involved in the middle of the seed, in a perfect state, and of a beautiful green colour. The large leaves, also, which spread themselves over the surface of the water, fold themselves together like an umbrella, at the setting of the sun, and gradually open again at his rising. These circumstances, conjoined with the general opinion among Oriental nations, that water was the primary element, and the first medium of creative influence, have naturally recommended this singular, useful, and beautiful plant to their imaginations, as the most expressive symbol of that influence. There are various kinds of the Lien-hoa, which are distinguished chiefly by the colour of the flower, the red and white, rose-coloured with single and with double flowers, pale red striped with white, and yellow, which is very rare, and which is supposed to be the same as the nymphæa of Europe. It requires no culture, and may be propagated either by seed, or more speedily by the root. Though it grows naturally in water, yet it can endure a considerable degree of drought; and, though rather fond of heat, yet produces the largest flowers in the northern provinces. Its seeds are eaten in China, as filberts are in Europe, and are reckoned most delicate when green, though more indigestible in that state. They are preserved also with sugar in a variety of ways. The root likewise forms an article of food, sometimes pickled with salt and vinegar, and eaten along with rice; sometimes powdered, and made into soup, with water and milk; and is said to be extremely wholesome in every mode in which it is prepared. Its leaves are employed in wrapping up fish, fruits, salted provisions, &c.; and, when dry, are sometimes mixed with tobacco, to render it softer and milder in smoking. In order to afford an example to the people in raising so valuable a vegetable, the government has commanded it to be cultivated in all the lakes, marshes, and waste grounds belonging to the state; and even the ditches, which surround the emperor's palace, as well as the canals in his gardens, are planted full of it. It covers entirely those immense sheets of water, which are in the centre of the city of Pekin; and when its leaves are green, and flowers in bloom, it forms one of the most beautiful objects in that capital.

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† One of them, measured by M. De Guignes, was about five inches in height, four in diameter, and thirteen and a half in circumference.

Flowers and flowering shrubs.

In the gardens, around the cottages of the Chinese, were observed beautiful asters and balsams, holly hocks, malva, amaranthus, and the nerium oleander, sometimes called the Ceylon rose. Around the lake See-hoo, the most prevailing flowers and shrubs, noticed also by Mr Barrow, were the hibiscus, lilac, mulberry, mimosa, rhamnus, sambucus, rose, juniper, cotton plant, amaranthus, xeranthium, epidendrum, flos acris, which vegetates without earth or water, celesia or cockscomb, jasmine, myrtle, rosa sinica, tuberose, China pink, sweet basil, sweet-scented olive, peony of various hues, and a species of magnolia, of which the flowers appear before the leaves. Some of the more remarkable flowering shrubs, peculiar to the country are,—the oo-tong-tchu, resembling a sycamore with large leaves, upon a stalk about a foot in length, extremely bushy, and so loaded with flowers as completely to exclude the rays of the sun.—The mo-lien, which has a few slender branches, covered with red bark, studded with small white spots, with a small number of large broad leaves at the lower extremity; and which bears in the month of December large flowers of seven or eight sharp-pointed petals with long filaments at their extremities, all the leaves dropping off when the flower begins to blow.—The la-moe, resembling the laurel of Europe, and also bearing flowers in winter of a yellow colour, and an agreeable smell like that of the rose.—The tcha-hoa, resembling the Spanish laurel in its wood and foliage, of which the leaves do not drop in winter, and the flowers of which appearing in December, of a fine rose colour, adhere without any pedicle close to the branches.—The yu-lan, one of the most beautiful ornaments of the Chinese gardens, which rises to the height of a tree, and when in flower, resembles a cropped walnut bush with its branches stuck full of lilies; but its flowers, which perfume the air to a great distance, remain only for a few days.—The autumnal hai-tang, originally brought from the rocks on the Chinese coast, celebrated by their poets as the rose or lily by those of Europe, and the flowers and foliage of which are very generally imitated by their painters and embroiderers in ornamenting their works, has branches of a fine purple hue, covered with prickles of a deep green colour, bears its flowers in clusters at the extremity of its branches, which resemble the blossom of the peach tree, and which shoot out anew, as the old petals drop off.—The moo-tan, or peony shrub, called also the king of flowers, an object of great attention among the florists of China, who vie with each other in producing the finest specimens, and sending the best to the Emperor, is a large shrub like the orange tree, and bears a showy sweet-smelling flower, like a rose, of a beautiful gold colour.—The pe-ge-hong, or "red of a hundred days," so named from the duration of the flower, the calyx of which is red on the outside, or a pale yellow within, containing six crimson coloured petals, each supported by a slender whitish stalk: these flowers, growing in bunches at the extremity of the branches, succeed each other, if properly shaded, for the space of three months.—The ye-hiang-hoa, or "flower which smells in the night," has weak slender branches, requiring to be supported by bamboo reeds or hoops, and bears a greenish yellow flower, which emits an exquisite perfume during the night. It is highly valued by the Chinese, who purchase the finest plants sometimes at the rate of 30 taels (about L. 10); but it thrives only in the southern provinces, and can be preserved at Pekin only in hot-houses.—The kiu-hoa, or parthenium, which the Chinese florists have brought to great perfection, both as to beauty and odour, and of which they are said to enumerate more than 300 species, propagating it by seeds, suckers, grafts, or slips, and sometimes producing varieties, by joining together two slips of different colours, tying them closely with pack-thread, after cutting a notch in each nearly to the pith.

Medicinal plants.

The medicinal plants produced in China are represented as extremly numerous and valuable. The most remarkable are rhubarb, the best of which grows in Se-tchuen, and of which those roots which are heaviest and most variegated with veins of different colours, are most preferred.—Hiao-tsao-tong-kong, or "herb in summer becoming worm in winter," which is a rare plant, supposed to be originally from Thibet, resembling ginseng in its properties as a stomachic and general tonic, and from its soft substance and yellow colour, remarkably like a caterpillar worm in its appearance.—San-tsee, that is, "three and seven," so named from having three leaves at the extremity of its middle and highest stem, while there is only one at the end of the other seven stems, and the root of which is accounted a sovereign remedy in the small-pox; and as a species of grey goat is fond of browsing on its leaves, the Chinese physicians have supposed the blood of these animals to possess the same properties as the herb itself.—Cassia-tree, which is found chiefly in the western parts of Yunnan, and which bears long pods resembling a hollow pipe divided into several cells, and containing a pulpy substance similar in taste to the cassia used in Europe.—Foo-lin, supposed to be a kind of mushroom, growing always in the vicinity of pines, several feet beneath the surface of the earth, attached to their roots like a fungus, and of which as

Ginseng.

experienced Chinese botanist is said to be able to discover the precise situation by the smell which it exhales. It is said to admit of being transplanted; and its inner part is used as a remedy in diseases of the liver, chest, &c. but it is said to be necessary for the patient to abstain from acids while using it.—Artemisia, or mugwort, called in China the physicians' herb, is used for a variety of purposes. It is kept in flower-pots as an ornamental plant, and continues long in flower. Its leaves, when powdered, are taken as a styptic in cases of bleeding at the nose, or in spitting of blood. The leaves of the prickly mugwort are often dried and used as tinder, or as stuffing in making mattresses, quilting, &c. This is chiefly the use made of the wild mugwort, the leaves of which are more soft and silky, and the downy balls of which are formed into girdles for the sciatica, or quilted stockings for rheumatism in the limbs.—Tchoang, a name given to the large comfrey, the root of which is taken by the wealthy Chinese in pills, or in decoction, every morning, as a salutary medicine in general.—Ginseng, called by the Tartars Orhota, that is, "the queen of plants," is the most esteemed of all the Chinese medicinal plants; and, in their opinion, is possessed of almost every possible property. It abounds in the mountains of Eastern Tartary, in places where the trees are tall, and the ground free from underwood, and forms the principal wealth of that country. No private person, however, is allowed to gather it, but the Emperor sends yearly ten thousand soldiers for the purpose of collecting it; a service apparently rather unwarlike, but yet neither exempt from danger nor fatigue. They are loaded with their provisions, consisting of toasted millet; have neither beds nor tents; but pass the night in the forests or at the foot of a rock, exposed to all the inclemencies of the weather, for the space of six months. A certain extent of forest is allotted to every hundred, and these again are stationed at certain intervals in bands of ten men, and then advance in a regular line, searching carefully for the plant as they proceed. After the time, appointed for traversing a given space, is expired, the mandarins, who preside over the work, and who reside in tents in the neighbourhood, send messengers to see that the number of troops be complete, to search for such as may have lost their way, to fill up the places of those who have perished by wild beasts, and to appoint another portion of ground for them to pass over. Ginseng, besides being employed in almost every disease by those who can procure it, is regarded as a general cause of longevity, and is therefore used by such as are in good health, as a mean of increasing and preserving their vigour. The Jesuit Lafitau, guided by the description given of the Chinese ginseng by Jartoux in *Lettres Edifiantes*, discovered the same plant in the woods of Canada, in 1745; and, according to his account, the Indian name, *Garent-oguen*, has a similar signification as the Chinese word ginseng. Both of them signify a man's thigh, an appellation which has been given to the plant, because its roots are often found to resemble the body of a man from the middle downwards; and hence it has been supposed by some botanists to be the same with the Mandrogora of the ancients.—A celebrated drug among the Chinese, called Ngo-kia, may be here mentioned, though it is not indeed a vegetable, but merely a kind of glue made from the skin of a black ass, after it has been steeped in the water of a particular well near the city Ngo-hien, in the province of Shan-tong. It is supposed to be useful in various distempers, but chiefly, according to the report of the missionaries, in diseases of the lungs.

Trees.

Throughout the vast extent of the Chinese empire, is found every kind of tree known in Europe; and a multitude of others peculiar to the country.* The most useful and singular are:—The Tie-lee-moo, or iron wood, which grows to the height of the oak, and the wood of which is remarkably hard, and so heavy as to sink in water; whence it is generally used by the Chinese in making anchors.—The Nan-moo, or Chinese cedar, one of the tallest trees and most durable kinds of wood in the country, which is much used in making the beams and pillars of the Imperial Palaces.—The Lo-ya-song, a species of pine, resembling that of Europe, but distinguished by several peculiarities, such as, that its leaves fall in autumn, that its wood is exceedingly hard, and that its sap is of a poisonous nature, occasioning pimples and blisters on the skin of the workmen in cutting it.—The Siang, resembling a chesnut, especially in its fruit, the external husk of which is employed as a substitute for the gall-nut in dyeing, and the kernel given to the hogs, though sometimes boiled in water and vinegar, and used by the mountaineers as food.—The Lung-ju-shu, about the size of a plum-tree, the wood of which is employed in making furniture, and the fruit of which, resembling unripe cherries, yields a kind of jelly, with which the country people rub their hands in winter, as a preservative from chilblains.—The Tcha-ke, said to be without bark, to burn readily even when green, to last longer than any other fire-wood, and, when made into charcoal, to produce a strong heat without either smoke or smell.—Tchoo-koo, a kind of sycamore, resembling the mulberry in its appearance, but the fig-tree in its fruit, and the inner bark of which is used in the manufacture of paper.—The Kin kooang-tsee, or sour jujube, a large tree, with fine-grained wood, and fruit resembling large jujubes, the stone of which is shaped like a heart, and formerly much used as a superstitious ornament.—The Tse-sing-yuen-pe, or juniper cypress, resembling the juniper in its wood and the cypress in its leaves, with a round green berry, larger than that of the juniper, containing two reddish grains shaped like a heart, and extremely hard.—The Oo-kieoo-moo, or tallow-tree, about the size of a cherry tree, with leaves of a bright red colour, shaped like a heart, the seed or fruit of which is surrounded by a pulp resembling tallow in colour, smell, and most of its properties, which, after being mixed with a little linseed oil, is made into candles, but from its not being sufficiently purified, they generally burn with a thick smoke, faint light, and unpleasant smell.—The Wax-tree, of which there are two kinds, one short and shrubby, growing in dry rocky ground, and the other taller, requiring a moist soil. On these trees, a kind of white wax is deposited by certain small insects, which do not naturally frequent them, but which, when once placed upon them, always remain. The wax, which is gathered in September, is white, bright, and transparent; and a single ounce of it, mixed with a pound of oil, is said to produce a substance little inferior to bees-wax. It is much used as a salve; and is also taken by the Chinese, in a dose of one ounce, as a stimulant or exhilarant, when they have occasion to make any public appearance, which requires courage and assurance.—Tong-tchoo, resembling the walnut, when covered with its fruit, from the kernels of which is pressed a peculiar oil, which burns well, though with much smoke in its natural state; but which, when duly prepared, is known by the name of Meng-yeoo, or oil of wood, much used by the Chinese as a paint or varnish.—The Tchoo-tchoo, or varnish-tree, resembling a small ash, and bearing neither flowers nor fruit, yields from incisions made in its trunk, a reddish gum, of a very acrid nature, of which is prepared the celebrated varnish used by the Chinese. It is so valuable, that the proprietors of these trees are said to let them to merchants for the season, at the rate of three pence per foot; but so very corrosive and poisonous, that the workmen, who collect it, are obliged to cover their faces and hands, and also to rub themselves with a preparation of rape oil, as a security against its malignant vapour, which, without such precautions, is said to generate a disease resembling the leprosy. A pound of this varnish is supposed to cost the merchant at least 1s. and 8d. sterling; but is highly valued by the workers in varnish, as it not only communicates a beautiful transparent gloss to the wood upon which it is laid, but also preserves it effectually from damp and worms.—The Tse-tan, or rose wood, is of a blackish red colour, beautifully striped and variegated; is remarkably heavy, and of an agreeable smell; and is made into various articles of furniture, which are sold at higher prices than the finest varnished work.—The Tchang, or camphor tree, which grows to a large size, and the wood of which has a very penetrating smell, which prevents it from being attacked by worms. The camphor is procured by cutting the young shoots into small pieces, steeping, boiling, and straining; and it is purified by being exposed in a copper bason to a moderate heat, between layers of a finely pounded old earth.

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* The Chinese gardeners have a wonderful passion for reducing their flowering shrubs, and even their forest trees, to a dwarfish size; and the missionaries assure us, that they have seen cedars and pines, which were more than 40 years old, and yet not above two feet in height, while the trunks, branches, and leaves, were all well-proportioned.

Bamboo.

—The bamboo, a reed which grows to the height of a tree, of 20, 30, and 40 feet, abounding in every part of China, but particularly in the province of Tche-kiang, where large forests of it are found. Its trunk is hollow, and divided by knots, but is capable of sustaining a considerable weight. It is applied in China to a greater variety of purposes, than any other substance whatever. Its young shoots are used as food, and its fibres as wicks of candles. Its hollow stems are employed as pipes in conveying water, or are split into thin threads, and woven into matting or cables. Its wood is bruised and made into paper, or in its more solid state is employed in making all kinds of furniture and utensils, trunks, chairs, tables, bedsteads, wheel-barrows, carts, fences, water-wheels, &c.—The Koo-tchoo, resembling the fig-tree, and yielding a milky juice used by the Chinese in laying on gold leaf in gilding.—The Tong tsao, a species of cane or bamboo, resembling the elder of Europe, the pith of which is carefully dried, rolled, and sliced into thin pieces for the use of the painters of artificial flowers, fruits, and insects.—The Betel, which grows like ivy around the trunks of trees, the leaves of which, mixed with the areca-nut, the Chinese chew almost continually, presenting it to each other as Europeans do their snuff or tobacco, and which they consider as strengthening the gums, preventing bile, and relieving asthma.—The cotton-tree is cultivated successfully in the southern provinces; and generally sown after the grain is reaped.—The mulberry-tree, which attains in some provinces, a greater height than in others, but seems to thrive in every soil, is chiefly cultivated for the sake of its leaves in rearing the silk-worm, but its fruit also is eaten by the Chinese.

Sugar-cane

—The sugar-cane, which grows in China to the height of six or seven feet, with the knots at a distance of six or seven inches, is cultivated chiefly in the southern provinces, and planted much in the same manner as in the West Indies. The juice of the cane is expressed by temporary mills erected on the plantations, consisting of a pair of cylinders, sometimes of stone, but generally of hard wood, placed vertically, and put in motion by oxen or buffaloes. From the bottom of these rollers the expressed juice is conveyed by a tube carried under the floor, into a boiler which is sunk in the ground at one end of the apartment, where it is boiled to a proper consistency. The Chinese are not acquainted with the mode of refining sugar; but they procure from the cooling syrup a very fine kind of sugarcandy, which is sold at Canton in a pulverized state, as white as the finest refined sugar in Britain. The molasses are used chiefly in preserving fruits, and particularly in making a conserve of the roots of ginger, of which the Chinese are remarkably fond. Sometimes they are distilled along with fermented rice, in the preparation of a kind of burnt wine, already mentioned.

Tea.

—The Tcha, Tha, or Tea-tree, grows equally in the mountainous and level districts; but it prefers a light and rocky soil. It is sown in March, by putting seven or eight seeds into one hole, of which often only one or two spring up. The young plants are afterwards transplanted in rows, and in spaces of three or four feet around each of them. They yield crops of leaves three years after being sown, but they require to be renewed every five or six years, as the leaves then begin to grow hard and harsh. The appearance of the tea-shrub resembles that of a myrtle, its root that of the pear-tree, and its flowers those of the wild white rose. On the more tender branches grow small soft berries of a green colour, filled with yellow grains, and on the other branches pods of a larger size and of different shapes, some round, containing one pea, and others long, containing two or three. There are different modes of cultivating the tea-plant in different provinces. In Kiang-nan it is not allowed to grow higher than six or seven feet; but in other places, to the height of ten or twelve. In the southern provinces, when not cultivated for the sake of its leaves, it is frequently planted in hedge-rows. The leaves are gathered at the beginning, the middle, and the end of spring; and their colour is different, according to the time of gathering. At the beginning of the spring, they are of a bright green, of a livid green about the middle, and of a dark green at the end of the season. The new leaves from the young plants are accounted of the first quality; those which push out immediately after these, of the second; and those which appear last, of the third. The leaves from the extremities of the branches, and from the higher parts of the shrub, are the most tender, those from the middle of the bush are less so, and those from the lower parts are more coarse. After the leaves are collected, they are exposed to the steam of boiling water. They are then made to shrivel or roll together, by being placed on plates of copper, of iron, or of baked earth, held over the fire, and are next dried thoroughly by exposure to the sun. The green teas, however, are not exposed to the sun's rays, which are said to make their colour black; and in the preparation of some of the finer sorts, especially that which is called Tchu-tcha, every leaf is rolled singly in the hand with great care.* The Chinese give the name of Tcha, however, to several vegetable productions, which are not really tea; and among other substances, a species of moss particularly, which grows upon the rocks in the province of Shang-tong, is often mixed with genuine tea, and sold in its stead even in China.

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* Mr Osbeck affirms, that, in the course of preparation, the tea passes through many dirty hands; and that particularly in packing it in the chests, it is trodden firm by the naked, and sometimes bleeding, feet of a Chinese porter, in a state of profuse perspiration.

The different kinds of tea.

There are, in fact, only two kinds of tea, the green and the black; and all the rest are either mere combinations of these two in different proportions, or are simple varieties produced by difference of soil, of culture, and of gathering.

Black tea.

The black teas are generally brought from the province of Fo-kien. Of those the most common is the bouy, or rather vouy, as the Chinese pronounce it, or bohea, as it is more generally called. It takes its name from a celebrated mountain in the province of Fo-kien, called Vouy, which is covered with pleasure-houses, temples, and hermitages of the Bonzes. When of a good quality, this tea should have a colour of a black cast, leaves of a moderate size, a little rounded in their shape, and a little reddish in their hue. If it resists, and as it were pricks the hand upon being touched, it is a proof of its being well dried; but if it breaks, and crumbles into powder, it is then too old, or too much roasted. The water, in which it is infused, should have a deep yellow colour, and a taste not over austere. It is more esteemed by the Chinese than the green tea, and is accounted lighter, sweeter, and a better stomachic. It is sold from 12 to 15 taels per pic.—The congo, or rather cong-foo, is only a finer kind of bohea; and its infusion is of a lighter colour, inclining to green. Its odour, however, is seldom so agreeable. It costs from 25 to 27 taels per pic.—The saotchong, or sushong, is one of the finest kinds of black tea; and its leaves, after being unfolded in the water, should be free from spots. It communicates a delicate greenish tinge to the water, in which it is infused, and has a very agreeable odour. It is sold from 40 to 50 taels per pic.—The pekao is the mildest sort of black tea, and said to be the least heating in its effects. It gives a light greenish tinge to the water, and has a sweet violet smell. It is sold from 34 to 60 taels per pic. There are also other black teas, named campouy, pao-tchong, and ankay, the last of which is a coarse tea from Kiangnan, which is seldom exported to Europe.—The Padre sushong, or the Poo-eul-tcha, so called from a village of that name in the province of Kiang-nan, is gathered from tea plants, which are allowed to attain their greatest natural size, and which are very tall and bushy. The leaves of this tea are long and thick, not shrivelled like the other teas, but packed up in masses like tobacco, and sold at a high price. It gives a reddish tinge to the water, and has less flavour than other kinds. Osbeck calls it the best tea that can be drunk, while De Guignes speaks of it as having a sweetish taste, and in no respect agreeable. It is employed chiefly, he adds, as a remedy in colics and diarrhœas, and has the effect of stimulating the appetite.—The mao-tcha, or imperial tea, sometimes called bing, which is reserved chiefly for the use of the Emperor, is composed of the tender leaves, which are collected from the young plants of the bohea. Its leaves are large, and of a beautiful green colour. It communicates a green tinge to the water, and has a slight smell of soap.

Green tea.

The green teas are produced chiefly in the province of Kiang-nan; and are conjectured by Osbeck to be naturally the same as the black; but to derive their peculiar colour either from repeated dryings, or from being exposed to the heat upon plates of copper, while the other are laid upon plates of iron;—a proof of which he finds in the circumstance of green tea having a tendency to occasion purging, while the black has rather an opposite effect. The principal green teas, are the Songlo, which is so named from a mountain in Kiang-nan, under the 30° of north latitude, which is covered with tea shrubs. Its leaves are longer and more pointed than those of the black tea, and they ought to be of a bright colour without spots. It is of an inferior quality when its leaves are yellow, or its smell like that of pilchards. Its appearance should be livid, and its infusion green. It is considered as of a corrosive nature; and is sold from 24 to 26 taels per pic.—The hay-suen, or hyson, which, when of a good quality, is of a livid colour, tinging the water with a lively green. Its leaves are bright without spots, and entirely unrolled after infusion. It has a slight odour of roasted chesnuts; is considered as very heady; and is sold from 50 to 60 taels per pic.—The tchu-tcha, which is rolled up with the hand in a round form like a pea, and a smaller kind of which is that called *gunpowder tea*, is sold from 65 to 70 taels per pic. There are other green teas, the Tonkay, the Hay-suen-skin, the Shulan, and several sorts, which are little known even at Canton; but in these distinctions, says De Guignes, there prevails no small degree of quackery. There is a kind called Kael-tcha, which is merely the refuse of all the other kinds mixed together, and which is chiefly sold to the Mogul Tartars, a people who, from eating great quantities of raw flesh, are much afflicted with indigestion, when they do not make use of tea; and who, in regard to that article, are not remarkably delicate in their taste.

Mode of proving, Preserving, And using tea.

The manner of proving the finer teas, is to put a small quantity into a cup, to pour on it pure spring water at the full boiling heat, to place the saucer above the cup, filling it also with boiling water to increase the heat, and, after a sufficient time has elapsed for the leaves to unfold themselves, to examine their appearance, and the colour of the infusion. In China, the common tea is preserved in narrow-mouthed earthen vessels, but the finer sorts are inclosed in porcelain vessels, lead or tin canisters, covered with fine bamboo matting; and the people, both of that country and of Japan, generally keep their tea till it be a year old before using, as they conceive it to possess too much of a narcotic quality when new. In using tea, the Chinese generally pour boiling water on it as is done in Europe, and drink it without milk or sugar; but in many places, both in China and Japan, the tea is reduced to a fine powder, and placed in a vessel upon the table, the cups are filled with boiling water, a tea-spoon full of the powder thrown into each cup is then stirred about till the liquor begin to foam, when it is drunk off while quite warm. A general rule among the Chinese also, is not to drink tea when fasting, as it is then more ready to affect the nerves, and to create giddiness, especially in persons of a spare habit of body.

Attempts to introduce the tea shrub into Europe.

The tea shrub is cultivated only in China and Japan, and is supposed to be indigenous to one or both of these countries. The attempts to introduce the plant into Europe have repeatedly failed, chiefly it is supposed from the bad state of the seeds. It is recommended by those, who have resided in China, to procure the seeds fresh, ripe, and white; to inclose them in wax after having dried them well in the sun, or to shut them up in their husks in a box made of tin, or rather to sow fresh seeds in boxes of fine light earth immediately upon leaving Canton, covering them with wire to keep off rats and other vermin; to preserve them carefully from the sea-dew; to water them gently now and then with fresh or with rain water; and, when the shoots begin to appear, to shelter them from the sun, and keep them slightly moist. But it may be questioned whether the tea plant could be cultivated, and the tea prepared in any European country,* where the price of labour is so high, at a much lower rate than it is brought from China. The cultivators of it in that country are said to sell the very best to their own merchants from 4d. to 2s. per pound, who again dispose of it to the East India Company at the rate of 8d. per pound for the ordinary kinds, and 2s. 8d. for the finest parcels.†

Animals. Wild. Game.

In China, there are few animals which are not to be found in other countries of the East, though, in such an extensive empire, there may naturally be supposed to be numerous diversities in the appearance even of the common tribes. Wild animals of every species, except the lion, which is unknown in China, abound in the mountains and forests; the elephant, rhinoceros, leopard, tyger, wolf, bear, buffalo, camel, dromedary, horse, ape, &c. Some of the *camels* are not higher than horses, and have two bunches on their shoulders. A species of *tyger* without a tail, and with a body resembling that of a dog, is described as remarkably swift and fierce; and the Chinese affirm, that when a traveller escapes his fury by ascending a tree, the creature stations himself at the root of the tree, and, by uttering loud yells, brings to the spot all of the same species within hearing, who, by their united endeavours, dig up the tree by the roots, and devour their miserable victim. The Chinese hunters are said to destroy this animal, by forming a circle of strong palisades, within which they take their stand, and attract the tygers to the spot by imitating their cry, and then dispatch them with their arrows while attempting to dig up the stakes. There are various kinds of *apes*, one species of which named sin-sin, but suspected to be altogether a fabulous animal, is described as equal in size to an ordinary man, and as imitating very nearly the motions of human beings. A species of *flying fox* is also said to be found in the frontiers of Northern Tartary, which, by means of a thin membrane extending on each side from his fore to his hind leg, is able to dart from one tree to another, but always from a higher to a lower situation. A rat as large as an elephant, a tyger resembling a horse covered with scales, griffins, dragons, and other chimeras, some of which are described in a printed collection of observations by the emperor Kang-hee, furnish sufficient proof of the deficiency of the Chinese philosophers in the department of natural history. Those wild animals denominated game are said to be remarkably abundant; stags, deer, goats, elks, hares, rabbits, squirrels, &c. A kind of *stag*, not much larger than a middle-sized dog, is described as one of the most beautiful quadrupeds in China, and is bought by the mandarins, to be kept as curiosities in their gardens. The *musk deer* is very common in all the provinces, is nearly of a black colour, and without horns, and its flesh is frequently used at the most luxurious tables. The musk is found only in the male in a thin membranous bag, covered with a fine soft hair. Some of the missionaries affirm, that the ordinary food of this animal is the flesh of serpents, which it easily procures by stupifying them with the odour of its musk; and that the Chinese peasants knowing this fact, secure themselves from these reptiles, by carrying always a few grains of musk about their persons.

Domestic animals.

The domestic animals in China are less numerous, than the extent of the empire and number of inhabitants might afford reason to expect. Few are employed in the labours of agriculture, and still fewer are reared for the use of the table. The *horse* in China has neither the strength, beauty, nor swiftness of the European breed. Some of the emperor's stud are not deficient in size and spirit; but no means are used to improve the breed. The Chinese horses in general are not provided with shoes, so that their hoofs are soon destroyed, and, in six years, the best of them are rendered totally unserviceable. A Scotch poney, in short, wild from the mountains, and untouched by the comb, is affirmed to be equal in appearance and usefulness to any of the cavalry in the Chinese emperor's service. Asses, mules, and buffaloes, are more numerous than the horses, and are chiefly used in the labours of agriculture. The *mules*, as formerly mentioned, are preferred even to the horses in riding, as being more sure and easy in their motion, more capable of enduring fatigue, and of subsisting upon little nourishment. The *buffaloes* are generally of a gray colour, with horns almost straight, and are commonly sold at 10 taels per head. The *sheep* are of the broad-tailed species, and are said to become very fat in the mountain-pastures. The *hogs*, which are the most abundant of the tame animals, are generally of a black or white colour, and remarkably prolific, frequently producing seventeen or eighteen young at a litter. They are more cleanly in their habits than those of Europe, and are kept in the houses like dogs.

Birds. Water fowls.

Among the wild birds of China are eagles, falcons, pelicans, swans, storks, birds of paradise, paroquets, &c. The most beautiful of the feathered race in that country is the Kin-kee or *golden pheasant*, the body of which is finely shaped, its plumage inconceivably brilliant, and its flesh extremely delicate. The most courageous bird, and that which the Chinese consider as the sovereign of the birds of prey, is called hai-tsing, a species of *hawk*, said to be found only in the province of Shen-see, and always accounted the property of the emperor, to whose falconer it is required to be conveyed. Another of the more remarkable birds in the country, namely the fishing *corvorant*, called by the Chinese Leu-tze, has already been mentioned; and it may here only be added, that these birds are often as large as a goose, and so strong as to be able to raise from the water a fish of their own weight. Many of the *sparrows* are extremely beautiful, some having white breasts, some a green head and tail, and some the head, back, and top of the wings, of a purple colour. Immense numbers of herons, cranes, guillemots, and other aquatic fowls, frequent the extensive swamps of China; one of the most beautiful of which is the anas galericulata, usually called the *mandarin duck*, as it is generally bought by the higher classes to be kept in their aviaries.

Poultry.

The Chinese are in the practice of rearing numbers of poultry, pigeons, geese, quails, and particularly ducks. A live *quail* is commonly carried by the wealthier Chinese, in cold weather, instead of a muff. Next to the breeding of swine, the Chinese are much occupied with rearing *ducks*, which almost invariably compose one dish at the table of the higher classes. Many of the people of Canton earn a subsistence by rearing those creatures; some hatching their eggs in sand baths, arranged in ovens; some tending the young, inuring them to the water, and to the use of the young fry and craw-fish on the banks of the rivers; and some occupying themselves with feeding the flocks of the full grown fowls. In this latter business they take the ducks on board of a broad-bottomed boat, with a bridge, which lets down as a passage to the shore. The young brood are put under the guidance of an old duck, who leads them out to seek their food upon the beech and rice fields; and, upon receiving a signal, generally a whistle from the owner, brings them back to their proper sampane, which is then moved to another place in quest of more food.

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* The tea plant at Sion, belonging to the Duke of Northumberland, is said to have been the first that flowered in Europe; but the finest known in England, was raised from seed in Kew gardens by Sir J. Ellis.

† For a more minute description of these and many other Chinese plants, shrubs, and trees, we must refer our readers to Osbeck's *Voyage to China*, passim, or Grosier's *Description of China*, vol. i. ad finem.

Fish.

The greater part of the best fish of Europe, the sturgeon, salmon, trout, herring, soal, pike, carp, &c. are affirmed by the French missionaries to abound in the lakes and rivers of China. The more remarkable, and the most esteemed as food, are the Tcho-kia-yu, that is the *fish in armour*, so named from its body being covered with sharp scales, the flesh of which resembles veal, and some of which are affirmed to weigh 40 lbs. The *flour fish*, so called from its white colour, great quantities of which are taken on the coasts of Kiangnan. The *pimoo-yu*, one of the most singular of the Chinese fishes, if their accounts could be credited, flat like the sole of a shoe, of a blackish colour, with only one eye, and without fins or scales on one of its sides; so as to have all the appearance of being only half a fish; and affirmed to be unable to swim, unless when united with a companion, when the two move on together as if forming only one individual. The Ming-foo-yoo, that is *the fish with the bright belly*, has a round head, a mouth like a falcon's beak, eight legs round its head, and two tufts of a beard, like two bunches of cord, by which it lays hold of the rocks, or bottom of the sea, when the water is strongly agitated, whence it is called by the Tartars Niomeré, or moored bark. The Kin-yu, or *gold fish*, which is kept for ornament in vases or small ponds, and which requires little other nourishment than the small worms and earthy particles found in the water, but which the Chinese sometimes feed by paste, snails, or lean pork dried and powdered. They are said to be so remarkably weak, as to be killed by a loud noise, a violent shaking of the vessel, or even by any very strong smell. Their spawn floats on the surface of the water, which they instantly devour; but if collected and exposed to the sun in a separate vessel, it is said that the young fry are thus produced. A fish resembling the Newfoundland *cod* is taken in great quantities on the coasts of Tche-ki-ang, and Fo-kien, salted, and sold throughout the empire at a low rate. A fish called *Hai-song*, or rather a shapeless, fishy mass, covered with excrescences like warts, is said to form a very common dish in China. It is killed by a very slight pressure, and, after being salted, is transported to every corner of the empire as a great delicacy, but was not much relished by the French missionaries. It is probably to this animal that Mr Barrow refers in these words: "Our old fisherman took out of the sea (among thousands which had floated round our vessel) one of those animal substances, which I believe are vulgarly called sea blubbers (mollusca medusa porpita.) It was at least a foot in diameter. Having dressed it for his supper, and seeing it wear the inviting appearance of a transparent colourless jelly, I was tempted to taste it; but the effect produced by this, or the fruit, or both, was a severe sickness, which continued for several days."

Insects.

Among the insect tribes, a variety of beautiful moths and butterflies abound in China, especially in the province of Quan-tong, where some of the latter are found of an extraordinary size, beginning to flutter about in the evening, but remaining motionless on the trees during the day, so as to be easily caught. *Silk insects*, resembling caterpillars, and somewhat different from the common silk-worm, are found in great numbers in the fields of Shang-tong. They propagate without culture, and feed upon the leaves of other trees, as well as those of the mulberry. They spin their silk, not in balls like the silk-worm, but in long filaments, which are caught by the trees and bushes as they are carried about by the wind. These are carefully collected and made into a kind of silk, which is very inferior in point of lustre, and resembles, at first view, coarse woollen or drugget, but which is often sold in China at a higher price than the finest satin, as it washes easily, lasts long, and is not so susceptible as other silks of being stained with oil. Upon a particular tree is found a kind of *nests*, called Oo-poey-tse, which are employed both as a medicine, and as dyeing materials. They appeared to European naturalists to resemble the excrescences upon the elm tree, usually called elm bladders, and were found to be much more astringent, than any other species of galls or vegetable substance yet known. The Chinese, however, consider them, not as excrescences, but as composed of a substance like wax, by certain insects, as a retreat for depositing their eggs, which have the appearance of fine dust, and with which these tubercles are filled. The largest of these tubercles are said to equal in size a man's fist, and the smallest to be as big as a chesnut. The Chinese collect them before the hoar frosts commence, destroy the worm within them by exposing them to the steam of boiling water, and then employ them as a black dye for paper or satin, or for their beards when they become grey. They are used also in medicine as remedies for hemorrhages, &c. and as antidotes to poisons. The *silk worm* of China has nothing peculiar. The houses, in which these insects are reared, are placed in the centre of the mulberry plantations, in order to be removed as far as possible from noise, as the bark of a dog, or a sudden shout, is often injurious to the young worms. They are watched with great attention night and day; and the young worms particularly are exposed to the sun in fine weather, upon thin gauze, stretched on wood or frames, and are replaced at night in the plantation houses.

View of the progressive intercourse of other nations with China.

China appears to have been totally unknown to the ancient Greeks, and is mentioned neither by Homer nor Herodotus. It has been conjectured, from a passage in Quintus Curtius, that Alexander the Great attained some knowledge of the Chinese during his conquests in India, about 327 years before Christ; and that it is to them the historian refers, in these words,—*hinc in regnum Sophitis perventum est. Gens, ut barbari, sapientia excellit, bonisque moribus regitur.*[*] In confirmation of this conjecture, it is added, that Strabo calls this kingdom of Sophites, Cathea, a word which is supposed to bear a resemblance to Cathay, the name given by the Tartars to China. The account, however, given by Quintus Curtius of the nation in question, does not apply so remarkably to the state and manners of the Chinese at that period, at least as described in their own histories; and his description, particularly, of the excellent dogs which they employed in hunting the lions, is utterly inapplicable to China, where we are assured that lions are not found; and where the figures of that animal upon their bridges, and other edifices, afford sufficient proof, that it has never ever been accurately described among them. Besides, it is to be observed, that, while Strabo gives the name of Cathea to the kingdom of Sophites, he fixes its situation between the rivers Hydaspes and Acesines.[†] It is the general opinion of the learned, that the Chinese are the same people with the Seres, mentioned by Horace, Virgil, Mela, Ammia-

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[*] Quint. Curt. lib. ix. c. 1.

[†] Strabo, lib xv.

Progressive intercourse with China.

nus Marcellinus, and particularly by Pliny, who mentions their gentle dispositions, their dislike of foreigners, and their silk manufactures. ‡ But not to insist, that Pliny's description applies rather more to the cotton tree than the silk worm, it is to be kept in view, that he proceeds to describe several other nations who dwelt beyond the Seres; a circumstance which could not be correctly affirmed of the Chinese, whose empire is bounded by the ocean on the east. About the year 126 before Christ, the Chinese are said to have extended their conquests so far to the west, as to have acquired some knowledge of Persia. ¶ The Parthians are said to have been known to the Chinese under the name of Gan-sie; and to have sent an embassy to the Emperor Han-tchang-tee, A. D. 88. Marcus Aurelius sent ambassadors to the Emperor Huon-tee, A. D. 166, who were called by the Chinese Ta-tsin, the People of the West; and from that period the Romans are said to have had a direct commercial intercourse with China, though much interrupted by the hostile measures of the Parthians and Persians. In 284, the Romans sent ambassadors to the Emperor Tsin-vootee; and, under the reign of Justinian, about the year 530, they first received silk worms from India, by means of two monks. In 567, Kosroe, king of Persia, sent an embassy to the Chinese, to engage them to take part with him against the Turks. In 643, the Romans sent another embassy, with presents, to the emperor of China.

The Arabs, having subjugated the kingdom of Persia, made their way to China, besieged and pillaged the city of Canton in 758. In 798, the Caliph Haroun sent ambassadors to the Chinese emperor, with a view to establish a commercial treaty; while the Romans, at the same time, carried on trade with them by sea, through the Persian Gulph; and this intercourse between China and the empire of Constantinople, continued to subsist till the invasion of Gengiz Khan, in 1211. Nicolas and Matthew Paul, or Polo, two Catholic missionaries, went to Tartary in 1260, proceeded to the court of Kublaikhan, and returned to Europe in 1272. They set out a second time, in company with Marco Polo, in 1274, and returned to Venice in 1295. In 1387, Tamerlane sent ambassadors to Tay-tsoo, the founder of the dynasty of Ming. In 1493, Bartholomew Diaz doubled the Cape of Good Hope; and in 1497, Vasco de Gama arrived in India. From that period, the European voyagers appeared in China, frequenting the ports of Canton and Ning-po. In 1517, Lopez de Souza sent from Goa a fleet of eight ships, conveying as an ambassador the Jesuit Thomas Pereira, who afterwards died at Pekin in prison. In 1563, the Portuguese obtained possession of Macao; and in 1573, the Jesuits formed an establishment on that settlement. In 1577, 1579, 1580, 1583, Fathers Herada, Marino, Alfara, Mendoza, and Ignatius, obtained admission into the Chinese dominions. In 1581, Father Roger, a French Jesuit, made his way into China, and Father Rici in 1582. In 1656, the first Dutch embassy arrived at Pekin, and resided there for the space of 91 days. In this embassy was Nieuhoff, the author of one of the earliest accounts of China. In 1667, another Dutch embassy appeared at Pekin, and remained 46 days. In 1693, the first Russian ambassadors entered China, under Isbrants Ides, a Dutchman, remaining 106 days. In 1720, the second Russian embassy, under Captain Ismailoff, arrived at Pekin, and remained 114 days. In the train of this embassy was Mr Bell of Antermony, an ingenious Scotch gentleman, whose travels from Petersburgh to Pekin afforded, at that period, so much new information respecting the Chinese empire. At the end of the same year arrived the Pope's nuncio Mezzabarba, and departed after a residence of 99 days. In 1753, the Portuguese embassy reached the Chinese metropolis, and remained only 39 days. In 1788, a Russian envoy resided at Pekin for the space of a year. In 1793, the British ambassador Lord Macartney was admitted to an audience of the Emperor Kien-long, and resided in Pekin 47 days. In the suite of his lordship were Sir George Staunton and Mr Barrow, two of the most intelligent writers on the state and character of the Chinese. In 1793, the third Dutch embassy, under M. Titzing, arrived at Pekin, making a residence of 36 days. In the suite of this embassy was the learned orientalist M. De Guignes the younger, whose travels to Pekin afford the most recent, and, in consequence of his long residence in China, the most accurate intelligence respecting that country.

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All these different applications to the Chinese government, appear to have chiefly proceeded from commercial views; but not one of them succeeded in accomplishing any thing approaching to a treaty of alliance, or the establishment of a free trade, with that haughty and suspicious court. The Chinese, on their part, seem to have regarded, or at least to have invariably represented, all these embassies as tributary acknowledgments to the power and grandeur of their emperor; and to have considered these respective nations as highly honoured in having received permission to offer their presents to their mighty monarch. All these nations are upon an equally precarious footing, and exposed to an equally degrading treatment, in their commercial visits to Canton; and the extent of the mercantile transactions, which have been accomplished, in such inauspicious circumstances, may be regarded as a peculiarly striking specimen of the persevering ingenuity and accommodating spirit of European traders.

Portuguese.

The Portuguese were the first Europeans, who frequented the ports of China; and the viceroy of Goa, Lopez de Souza, aided by the talents and address of the Jesuit Pareira, procured a kind of commercial treaty in favour of his countrymen in the year 1517. But while the ambassador was on his way to Pekin, the Portuguese officers provoked their new allies by their insolent excesses, to drive them from their coasts, and left Pareira in the hands of the enraged Chinese, by whom he was thrown into prison, where he died in a very miserable condition, after a confinement of three years. Within a few years, however, the Portuguese again found means to procure permission to trade with the Chinese on the island of Tancian, and to erect tents on shore, while the ships were taking in their cargoes; when an unexpected opportunity of essentially serving the Chinese government, introduced them to a more permanent settlement in that country, than any other European nation has ever enjoyed. During the protracted war between the people of China and Japan, a pirate of the former nation named Tchang-see-lao, took possession of Macao, blockaded the mouth of the river at Canton, and even laid siege to that city in the year 1563. The mandarins, unable to withstand his fury, implored the assistance of the Portuguese, who made a successful attack upon his fleet, pursued him to Macao, and put him to death. In return for this signal service, they received from the Chinese emperor a perpetual grant of the island of Macao, where they form-

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‡ Hor. lib. i. od. 12.; Virg. Georg. ii. v. 122; Pomp. Mel. lib. iii. c. 2.; Ammian. Marcellin. lib. xxiii. c. 28.; Plin. Hist. Nat. lib. vi. c. 17. lib. xxxiv. c. 14.

¶ Histoire des Huns, par M. De Guignes.

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Macao.

ed a settlement, and built a city in the year 1585. This island, which is only about one league in length, and half a league in breadth, is separated from the continent of China by a small tongue of land, which is defended by a low dry stone wall, feebly garrisoned by a few Chinese troops. The Portuguese city was not surrounded with walls, and was merely protected by a few forts, till the year 1622, when it was attacked by a Dutch squadron, who were completely repulsed with a loss of 400 men, 100 of whom, being taken prisoners, were employed by the Portuguese in constructing two strong walls on the north and south sides of the city, which, with several other defences afterwards erected, have rendered the settlement of Macao sufficiently secure to resist all the attacks of the Chinese. This settlement continued to carry on a very flourishing commerce as long as the Portuguese preserved their intercourse with Japan; but it has of late greatly degenerated from its former activity and wealth. Its actual commerce is by no means extensive, consisting of a single ship sent annually to Goa, one to Timor, one or two to Bengal, as many to Manilla, and three or four to Cochinchina. One or two ships arrive yearly from Lisbon, loaded with tobacco from Brasil, for which there is a great demand in China, and return with different kinds of Chinese merchandise. The expence of the settlement, consisting chiefly in the salary of the governor and of other public functionaries, and the pay of the garrison, is defrayed by a duty of ten per cent. upon the cargoes of the shipping. The more wealthy part of the inhabitants either lend their money at good interest, or employ it in fitting out merchantmen, while the poorer classes perform the voyages, and live during the intervals upon their gains. All the shop-keepers and artisans are Chinese, as the Portuguese would reckon themselves disgraced by engaging in any kind of handicraft. There is a Chinese as well as a Portuguese governor at Macao, and when the respective interests of the two nations interfere, the Chinese generally stop the supply of provisions, and the Portuguese are obliged to purchase peace and plenty by means of their dollars, which are always acceptable to the mandarins. The population is estimated at 12,000, of which number 8000 are Chinese.

Dutch.

In the year 1602, the Dutch formed a company for the purpose of trading to India; and in 1607, they made their appearance for the first time at Macao. In 1609, they cruized along the coasts of China, and established a commercial intercourse with Japan. In 1620, they formed a settlement upon the island of Formosa; and, in 1622, made their unsuccessful attack upon Macao. In 1653, the governor of Batavia dispatched a frigate for the purpose of trading with the Chinese; and, in 1656 he sent the first Dutch embassy to Pekin, which failed in its object of procuring liberty to trade with the ports of China. In 1662, they were driven from Formosa, by the Chinese pirate Tching-tching-kong; and in 1673 they assisted the Chinese in an attack upon the son of Tching-tching-kong, called Coxinga, who then held the sovereignty of the island. From this period they made regular commercial voyages to China; and in 1740, when a number of Chinese had been massacred in Batavia, they sent a mission to Pekin, which sufficiently exculpated them to the Chinese court with respect to that affair, and prevented it from producing any interruption to their intercourse. In 1795, they sent their last embassy to the court of Pekin, which was productive of so little commercial benefit, while it was attended with so many circumstances degrading to their national character. Of all the foreign companies at Canton, the Dutch continued to carry on the most profitable and extensive commerce with the Chinese, till their affairs in that quarter of the globe became so much destroyed by the recent conquests of the British. Every year, they used to fit out three, four, or even five Indiamen, from 1000 to 1200 tons burden, for the Chinese trade. These ships, leaving Europe in the autumn, proceeded to Batavia, where they landed their hardware and the stores for the use of that settlement, reserving for the Chinese market, the woollens, gold-wire, copper, and ginseng, and replacing the unloaded goods with sandal wood, clove-buds, pepper, nutmeg, birds nests, tin, wax, and rice. These articles, procured by them at little expence, and so much in demand among the Chinese, yielded an immense profit; and their prudent attention, which other nations have been advised to imitate, in shewing equal favour to all the Hong merchants, prevented them from ever being entirely at the mercy of any of them, and procured them more beneficial contracts. They are charged, however, with erring egregiously in several essential points, with failing to pay sufficiently those, whom they employ, and thus exposing themselves to the evil of being badly served; with exercising too little precaution in the choice of their ship captains; with paying too little attention to the proper construction of their vessels; with interfering too minutely in prescribing their route; and with maintaining too many factors at Canton, and observing too many tedious forms in their commercial transactions.

British.

The English had made several detached voyages to India before the year 1600, but carried on no regular trade with that quarter of the globe, till the establishment of an East India Company by Queen Elizabeth, about the end of that year. In 1613, they obtained permission from the Emperor of Japan to establish a factory at Firando for purposes of commerce, but afterwards abandoned this privilege, without any reason being assigned. They experienced numberless obstacles in the progress of their India commerce, from the intrigues of the Dutch and Portuguese, in these countries; but finally succeeded in extending their trade to China. In 1634, Captain Weddel obtained permission from the Viceroy of Goa to sail for Macao, where he had to encounter every species of discouragement and delay in the prosecution of his views; but at length, without waiting for more particular permission, he dispatched some of his people up the river to Canton, who experienced a friendly reception from the Chinese, and laid the foundation of that intercourse, which has hitherto subsisted between the two nations. In the early periods of this navigation, the English visited the ports of Emooy in Fo-kien, and of Ning-po in Tche-kiang; and even erected a kind of lodging upon the island of Tcheoo-shan, upon which they had accidentally landed, while in quest of the entrance to the river of Ning-po; but the Chinese, having afterwards restricted all foreign traders to the port of Canton, they have continued, like the other nations who trade with China, to have only one factory at that city. Their great article of export from Canton is that of tea, of which they take on board annually about 20,000,000 of pounds in weight, besides raw silk, silk stuffs, sugarcandy, porcelain, camphor, nankeens, &c. for which they carry thither, besides money, lead, tin, woollen and cotton cloths, pepper, and other articles of merchandize. In this commerce, they employed, in 1795, twenty-one vessels, the amount of whose united burden was not less than 20,900 tons; but of this nearly one third was employed in commerce merely Indian, while the remaining two thirds conveyed the cargoes of Europe. A considerable portion of their imports to

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China, especially the cotton, tin, pepper, &c. are carried from Madras, Bombay, Bencoolen, Surat, and the Straits of Sunda and Malacca; and it is this country-trade, from one part of India to another, which enables the British East India Company to maintain so brisk and lucrative a commerce with China. Their factory at Canton, which is the most expensive establishment of the kind, consists of twelve supercargoes and eight writers. The latter have only a small annual allowance and a free table; but succeed to the former by rotation. The former have also a free table at the expence of the East India Company, and divide annually among themselves, in shares proportioned to their seniority, a sum seldom less than £70,000, arising from a per centage on the value of import and export cargoes, producing to the chief of the factory from £10,000 to £12,000 per annum; and to the others from £1300 to £8000. Sir G. Staunton, junior, also was recently appointed Chinese interpreter and secretary to the factory, with a salary of £500 per annum.

French.

The establishment of an East India Company in France, first projected by Henry IV. in 1604, and afterwards canvassed under Louis XIII. in 1611, was at length effected in 1615, by a few merchants at Rouen. But their association failing in success, nothing effectual was done, notwithstanding all the exertions of Cardinal Richelieu, till Colbert issued letters patent for the creation of a new company in 1664. One association had been formed in 1660, a second in 1698, a third in 1713, which last was incorporated in 1719 into an East India Company. But this also having been abolished in 1796, the trade of France with China was carried on by a few private partnerships, till the year 1785, when a new company was created, which is said to have been badly organized from its foundation, and which was abrogated by a decree of the National Assembly in 1790, which pronounced the commerce of India beyond the Cape of Good Hope to be free to all the subjects of France. The French had, upon their first voyages to China, enjoyed the privilege, with other nations, of maintaining a factory at Canton; but, during the successive failures of their East India Companies, having been absent for a long period from the Chinese coasts, they were not permitted at their return to remain there as formerly; and it was not till the year 1728, that M. Duvelaer obtained permission to reside at Canton, from which, however, he was obliged, about three years after, to withdraw. In 1745, the French procured the privilege of landing on the island of Wampoo, upon paying 100 taels for each vessel; and their commerce never requires more than two or three ships from 700 to 800 tons each. The articles, which they used to carry out to China, were chiefly money, broad-cloth, looking-glasses, azure, gold-wire, and ebony; and those, which they brought back, were tea, raw-silk, silk-stuffs, nankeens, rhubarb, anise, and porcelain. Tea composed the third of the whole cargo, of which it is affirmed, that France itself did not consume above 300,000 pounds weight per annum, and that the remainder was thence exported to other countries.*

Danes.

In 1612, Christian IV. of Denmark issued a patent for the establishment of an East India Company in his dominions; but it was not till the year 1616 that any shipments were made for India. It appears, that the commerce of the Danes was very considerable about the year 1642, when the Dutch, who had then acquired the superiority in India, excluded them from several branches of traffic, while the wars in which their nation was involved in Europe at that period contributed no less powerfully to the diminution of their commercial undertakings. It was not till the year 1728, that their mercantile spirit revived under the powerful exertions of Christian V.; and it is from this period, that the intercourse of the Danes with China continued without interruption, till the late association of the Continental powers against Great Britain. They commonly fitted out two vessels annually for the port of Canton, where they used to maintain three residents, besides a supercargo, who went out and returned with each ship. But since the year 1795, they ceased to support a factory in China, on account of the great expence with which it is attended, and their commerce was conducted by persons annually sent out with their cargoes. These consisted principally of money, lead, amber, woollen stuffs, azure, and several articles of India merchandise taken on board at Tranquebar by one of the two vessels, while their principal article received in exchange was tea, which they afterwards transported to the north of Germany.

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Swedes.

In 1626, Gustavus Adolphus issued an edict for the encouragement of commerce with India; but the wars which then raged in Germany prevented the execution of his plan. His successor, Queen Christina, was equally desirous to promote the same object; but the Dutch contrived to supplant the Swedes in all their measures to attain the end in view. Charles XI. and Charles XII. were so successively engaged in war, as to have no leisure for attending to mercantile interests, and by the loss of some of their best commercial provinces, they placed their subjects in a still more unfavourable situation for maritime enterprise. But at length, after the destruction of the Ostend India Company, in 1717, a Swedish merchant, named Koning, formed the plan of an East India Company in his own country, and obtained an edict for its establishment in 1731. From that period, the Swedes have traded with China; and generally fit out two vessels annually, laden with money, copper, lead, steel, and azure, receiving in return a cargo consisting chiefly of tea, which, like the Danes, they sell to the people in the north of Europe. They maintain three residents at Canton, besides a supercargo, who goes out and returns with each ship.

Merchants of Ostend.

In 1698, Charles II. of Spain, as sovereign of the Low Countries, established an East India Company at Ostend; but in consequence of the wars which then began to distract the adjacent kingdoms, nothing was attempted till the year 1717, when a few private individuals fitted out commercial expeditions. By the hostile measures, and political intrigues of the Dutch, the operations of this company were continually impeded; and though in 1723 they procured new letters patent from the court of Vienna, they were compelled, by the jealousy of their neighbours, to desist from the undertaking, and were finally dissolved in 1727. The same association was afterwards renewed in 1780, under the name of the Company of Trieste; but after a few voyages, they again deserted the Indian trade.

Prussians.

In 1751, the Prussians established at Embden an East India company, which merely sends a ship occasionally to China, with a cargo, consisting generally of money, ginseng, lead, and rice.

Spaniards.

The Spaniards have frequented the ports of China since their settlement at Manilla; but this trade was carried on merely by individual merchants, till 1733, when Philip V. made an unsuccessful attempt to form an East

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* Since the year 1793, not a single French ship has appeared in China, except one or two small vessels during the short peace of Amiens in 1802.

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India company, which was afterwards resumed, with better fortune, by Charles III. in 1785. The company established by this prince, possess the exclusive commerce with Asia, but are bound to land their return cargoes in Spain, and are permitted to export to other countries only such articles, as cannot be advantageously disposed of at home. They have a factory at Canton, with three supercargoes; who make no purchase in tea, but chiefly send home silk stuffs, nankeens, and other Chinese productions.

Americans. The first American ship, appeared in China in 1784; and, from that period, the traders of that country have continued to repair to Canton in considerable numbers. Their ships are the property of individuals; but it was not till the French revolution, that they were able to carry out any money, which is always the most necessary article in Chinese commerce.

Origin of companies. The first European traders to China, were generally private individuals, like the American merchants, who at present appear at Canton; but the length and dangers of the voyage, and the various difficulties which were encountered in such distant expeditions, rendered them gradually averse to the renewal of similar enterprises. It has been uniformly, therefore, found necessary in every country, with the exception of America, to commit the commerce of India to exclusive companies; and this single circumstance, the result of actual experience, ought not to be overlooked in the discussion of this much agitated question. Without attempting in this place to enter upon so important an enquiry as that of commercial monopolies, and with a full conviction of their injustice and inexpediency, in *general*, it would be wrong to conceal, that exclusive companies are pronounced by M. De Guignes to be necessary for carrying on an advantageous trade with India, and especially with China.

The Chinese themselves have found it requisite to form something like an exclusive company on their part, in trading with the foreign merchants who visit their ports. At first, these strangers were at liberty to address themselves indifferently to any of the Chinese, who could furnish the merchandize in demand. But, these private dealers frequently absconded with the property of the foreign trader, and repeated complaints were thus brought by the latter before the mandarins; who, on their part, were often sufficiently embarrassed with levying the customs from the numerous purchasers. With a view to relieve themselves from both these subjects of contention, they formed an association of Chinese merchants, to whom they committed the exclusive privilege of dealing with the Europeans, upon condition of their becoming responsible for the duties on the respective articles of merchandize. This society, denominated Cong-hang, was first instituted in 1759, by a Tsong-too, named Lee; and, among other regulations, they were expressly prohibited from furnishing the Europeans with goods upon credit, or receiving, on the other hand, any of their funds upon interest. The chiefs of the different trading companies are obliged to procure a Hong merchant to become surety for the payment of the duties, and to be responsible for any frauds or contests between the foreigners and the natives. The Hong merchant, on the other hand, is enjoined to give his consent to become Fiador or surety, to take charge of the interests of the stranger, to procure a Comprador or contractor for purchasing his provisions, and a Lingua or interpreter for transacting his affairs; and to see that all his accounts are settled before the departure of the vessel. The Europeans are farther required to present themselves at the custom-houses, for the purpose of being inspected,* and are forbidden to pass the appointed boundaries, unless when accompanied by a soldier. Neither are they allowed to possess a house of their own, upon the penalty of confiscation of goods to the purchaser, and of exile or death to the Chinese who shall have made such a sale; but the Hong merchants are bound to give a perpetual lease of a lodging to each nation, and to be responsible also for all, who are permitted to occupy it. By the same regulations, it was enacted, that no European should be permitted to bring his wife to any commercial place in the empire, especially the city of Canton; and that no ship should ascend the river, without first obtaining permission from the Chinese government, and taking on board a pilot accredited by the mandarins. No vessel belonging to a nation, who had residents at Canton, was allowed to disembark any article at Macao, but must repair to Wampoo, in order to be measured, and to pay the duties of anchorage. It was bound also to take a cargo in return, of which the Hong merchant was to be charged with the duties; and, if it should ever happen that such a vessel should depart in ballast, the Hong merchant was still to be responsible for the duties, in the same manner as if a cargo had been taken. All Europeans were farther ordained, upon the departure of their respective ships, to retire to Macao, and to lodge in houses belonging to the Portuguese, which the Chinese government engaged to procure to be let to the different companies. No European, upon his arrival, or during his residence in China, was to be allowed to monopolize any species of merchandize, either upon his own account, or for the purpose of transferring it to others; and the Hong merchants were forbidden to sell to foreigners either red or yellow copper, or to furnish each ship with more than 100 pounds of raw silk. The interpreters, contractors, and Chinese in general, were commanded not to enter into the service of a European, without first obtaining permission from the mandarins. These regulations have not always been faithfully observed; and both have Europeans occasionally made monopolies of particular goods, and the Hong merchants borrowed the funds of the foreigners at interest. Many of them have even failed to a considerable amount with the property of the strangers in their possession; and, though the Hong merchants were in those cases obliged to pay the debts of their associates, yet they always took care to reimburse themselves, by advancing the price of their teas and other articles of traffic. Nay, they often went so far as to fix, among themselves, the rate of all the exported and imported goods; and thus levied immense sums from the Europeans, which they employed in making presents to the mandarins, and in meeting the unexpected demands of their government. The number of these Hong merchants is not always the same. There were eight of them in the year 1784; but since that time, four additional have been created by the Hopoo, who finds this exercise of his power a very gainful practice. Though the Hong merchants only have the privilege of dealing with the Europeans, yet the latter may transact business with private merchants of the country.

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* There are three custom-houses, where all, who pass in the Chinese boats between the ships and the town, are obliged to stop. They are built partly upon a rocky bank, and partly over the river, supported by piles. They have a bridge contrived in such a manner, that the boats may approach them at all times of the tide, as well during the ebb, as at the flood. Close to the house stands a flag marked with large Chinese characters, and their respective regulations are pasted upon the walls.

Commerce.

But few are ever permitted thus to interfere, except such as are actually brokers or factors, for the company of the Hong; and, though the government overlooks this species of unauthorized traffic, it is rather a hazardous speculation for the foreign trader; as, in the event of the Chinese dealer disappearing with his goods, he would not be allowed to make any application for redress. There is said to be little distinction made by the Hong merchants in their conduct to the different trading companies, except that they are disposed to give the preference to those, who bring into the market the largest sums of money, and who purchase the greatest quantities of tea.

Factories.

The factories or lodgings of the foreign traders are houses at the entrance of the suburbs of Canton, built close to the river, or over it, upon piles, and let by the Hong merchants to the European ships during their stay. They are only two stories high, but of very considerable length, one end stretching towards the river, and the other towards the factory street. They are built of unburnt bricks, and a great part of wood. They look like two houses built parallel and close to each other, with a court yard between them, which is paved like the floor of the ground story, with square or oblong stones, in which are little holes at certain distances, to let the water run through into the river. In every room, the foreign merchant finds a table, chairs, a bed with curtains of gauze or blue nankeen stuff, and a lamp fastened to the roof by means of a long rope. In the court yard are piled up the tea and porcelain chests, with other articles of merchandise; and in some parts of the yard are shades like coach-houses, with arched roofs for the protection of the goods from the weather. "A factory," says Osbeck, in his usually simple and descriptive style, "is mostly built in the following manner: Near the entrance of the street of the factory, on both sides of the gate, is a little apartment, upon which are commonly some papers with figures, like arms, and two round lanterns of bamboo, covered with skins; for glass or horn lanterns are quite unusual here. The gate of the factory is on the inside built over. Directly behind it stands a high board, almost as broad as the entrance, to hinder the people in the streets from looking into the yard or court, without being any obstacle to those who pass to and fro. In almost all corners are buckets, into which people make water, which is afterwards carried into the fields. The foremost rooms on the sides look like kitchens, and have rails before them. Farther on, quite across the court, in the second story, is an open hall, with a sort of gallery, upon which is an altar covered with flowers and incense, provided with a gilt picture and a table. Behind this, the yard is quite open in front, but on the sides are rooms both above and below. In the side roofs are here and there some lanterns of painted gauze, in some of which they burn lamps at night. Before the side roofs, and on their sides, are little gardens, with bamboo trees, citrons, and plaintains, and other trees already mentioned. The wall about these trees towards the yard is made of brick, which, except the foundation, are laid like lattice-work. Next to these gardens is an enclosed court-yard, and then an open one, with rooms and gardens for pleasure on the sides. The last of all is a hall in the second story across the yard, having rooms on its sides, which are fitted up for a dining-room. Below it is the kitchen, the watch-house of the sailors, and the lodging of the captain of the factory. The captain of the factory has a mate, who is to take care, that the sailors and Chinese workmen do their business; and he notes down those people, who come from or go to the ships with sampanes of burden. In the factories live the supercargo, the assistants, the purser, the cooks, and other servants, during the whole time of their stay; and besides them, those who come occasionally thither from the ships. There are continually some sailors, who watch with drawn swords in their hands, to hinder those from entering who have no right. They indicate the time upon the gong-gong; and beat upon it, as it were upon a drum, with sticks, when dinner or supper is ready. Every thing is carefully kept in the factories, both effects coming from the ships, viz. money, lead, cloth, raisins, almonds, &c. and those which are to be embarked, as porcelain, tea, silk, and many other things, which are brought on board by the sampanes of burden, after some mandarins, appointed for that purpose, have weighed them, and stamped a seal upon them. In each sampane, loaded with these and other things, goes a mandarin and some armed sailors, from the factory to the ship, to guard them, lest the master of the sampane should defraud them, as often happens, notwithstanding these regulations. The supercargo always sends a letter to the captain, or whoever has the command of the ship, with an account of all the boxes and packs, and the sailors bring an answer back. The flag of the factory stands on the water side, and is hoisted on all festivals." "The name we give to the Chinese servants is Kulier. These wait at table in the factories, bring in the meat, wash the dishes, &c. clean the knives and forks, fill the lamps in the yard and rooms with oil at night, clean the vessels, and do the like business; which the Chinese valets de chambre look upon as trifling in regard to sweeping the rooms, assisting in carrying the tea chests, and other wares in and out, &c. These and a Chinese cook are paid by the Company. Besides these, every one, or several together, hire a Chinese servant, who is paid some dollars per month. This person buys every thing you want, and frequently by this means avails himself more than by his wages. Happy is the man, who has not the misfortune of hiring a thief into his house; but often, however, it is the case."*

Reference to authors upon China.

See *Ancient Univ. Hist.* vol. xx. p. 109. where there is a short but judicious sketch of the early history of the Chinese empire; *Modern Univ. Hist.* vol. viii. p. 1, where may be found the substance of the accounts of China by the French Jesuits, with references to the principal writers of that class; Nieuhoff's *Voyage to China*, one of the earliest and most intelligent accounts of that country; Du Halde's *Hist. of China*; Grosier's *Description of China*; *Memoires Chinoises* par Amiot; *Histoire Generale de la Chine*, which is considered as an interesting monument of French science, but which abounds in exaggerated statements; *Three Years Travels from Moscow overland to China*, by Isbrands Ides; Osbeck's *Voyage to China*, which contains numerous observations respecting the botany and zoology of that country; Bell of Antermony's *Travels from Petersburgh to Pekin*, distinguished for accuracy and information; *Lettre sur les Characteres Chinois*, which contains a number of learned notes, and beautiful plates of various kinds of Chinese writing; *Lettre de Pekin sur la Genié de la langue Chinoise, par un Pere de la compagnie de Jesus, missionaire a Pekin*; Fourmont's *Gram. Sinica*; *Histoire de l'Academie des Inscr. et de Belles Lettres*, tom. xxxvi. in which will be found an account of Chinese writings; Marshman's *Dissertation on the Characters and*

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* Osbeck's *Voyage to China*, vol. i. p. 210.

Reference to authors.

Sounds of the Chinese Language, a work which is considered as presenting the most accurate and intelligible view of the subject, that has ever appeared in Europe; *Hao-kiou-tchuan, or Pleasing History*, translated by Dr Percy; Morison's *Horæ Sinicæ, or Translations from the popular Literature of the Chinese*; Sonnerat's *Voyage to India*; Paw's *Recherches Philosophiques sur les Egyptiens et les Chinois*, who, together with the preceding writer, is decidedly hostile to the boasted excellencies of the Chinese; Sir George Staunton's *Translation of the Ta-tsing-leu-lee, or Penal Code of China, and Preface by the Translator*; Weston's *Translation of the Conquest of the Miao-tse*, a poem by the Chinese Emperor Kien-long; Van Braam's *Embassy to China*; Barrow's *Life of Lord Macartney*. And especially Sir George Staunton's *Account of China*; Barrow's *Account of Lord Macartney's Embassy to China*; and De Guigne's *Voyage a Pekin*, which are by far the most intelligent and judicious productions on the state of the Chinese empire, and character of the Chinese people, and the last of which particularly contains a vast variety of useful and curious intelligence on the subject. (*q*)

Chiococca ‖ Chippenham.

CHIOCOCCA, a genus of plants of the class Pentandria, and order Monogynia. See BOTANY, p. 150.

CHIONANTHUS, a genus of plants of the class Diandria, and order Monogynia. See BOTANY, p. 85.

CHIOS. See SCIO.

CHIPPENHAM, a town of England in Wiltshire, is delightfully situated on the river Avon, which is crossed by a handsome freestone bridge of twenty-one arches, decorated with balustrades and lamps. The principal street is about half a mile long, and the houses are in general neat and well built. The church is a venerable Gothic edifice, supposed to have been built by the Hungerford family; but the market-house is a mean building, unworthy of such a town. The manufacture of superfine woollen cloth, of the very best quality, is carried on here, to a considerable extent, and is in such a flourishing state, that the inferior classes, to whom it gives employment, can scarcely procure dwelling-houses for their families.

Chippenham ‖ Chironia.

According to the recent population returns in 1811, the borough and parish, including the tythings of Allington, Nethereton, Stanley, and Tytherton-Lucas, contained

Inhabited houses	668
Families	857
Families employed in agriculture	145
Ditto employed in trade and manufactures	652
Males	1580
Females	1830
Total population	3410

See Britton's *Beauties of Wiltshire*, Maton's *Tour*, and the *History of the Boroughs*. (*r*)

CHIRK AQUEDUCT. See INLAND NAVIGATION.

CHIRONIA, a genus of plants of the class Pentandria, and order Monogynia. See BOTANY, p. 139.

CHIVALRY.

Chivalry.

THERE is scarcely any subject of antiquarian research so free from the reproach of uninteresting and unprofitable labour, as that which relates to the origin, the causes, the institutions, and the effects of chivalry. Some of our earliest and most pleasing associations are connected with tales of romance; and even after our judgment is disposed to reject them as rude and extravagant, the subjects which the most admired poets, of almost every nation, have chosen, lead us back to our former pleasures; and strengthen the hold they have on our imaginations, by enlisting on their side the approbation of a refined and cultivated taste. Nor are the antiquarian researches, which have chivalry for their object, less interesting and instructive to the philosopher. If he wish to inform himself of the opinions, the manners, and the pursuits of nations, at different periods of their progress from barbarism and ignorance, to civilization and knowledge;—if he wish to analyse, and to account for, those great and leading points of character, which distinguish modern from ancient manners, he must go back to the age of chivalry. Courtesy of manners, the point of honour, a more jealous and habitual attachment to truth than obtained among the nations of antiquity, and a refined, respectful, and delicate gallantry, may be traced from the period when chivalry first dawned, to the present times.

Whoever is equally conversant with the early history of Greece and Rome, and with the history of those barbarians, who overran and conquered the empire of the latter, must be struck with the different manners that distinguished them; and if he trace these manners during the more advanced state of the ancient world, when every thing else indicated refinement and civilization, he will still detect the same want of courtesy, the same inattention and disregard to the rights and comforts of the female sex, and the same indifference about personal honour, which existed in the ruder state of their society; while, on the other hand, among the barbarians, far behind the inhabitants of Greece and Rome in every other respect, he will discover those traits of character, on which the most polished modern nations particularly pride themselves.

Chivalry, therefore, characterised as it has justly been by an elegant writer, as consisting "in a passion for arms; in a spirit of enterprise; in the honour of knighthood; in rewards of valour; in splendour of equipages; in romantic ideas of justice; in a passion for adventures; in an eagerness to run to the succour of the distressed; in a pride in redressing wrongs and removing grievances; in the courtesy, affability, and gallantry, for which those who attached themselves to it were distinguished; and in that character of religion, which was deeply imprinted on the minds of all knights, and was essential to their institution;"—as it constitutes one of the most remarkable features in the history of the ancestors of almost all European nations; as its effects on our opinions, habits, and manners, may still be traced; and as it is interwoven with our earliest associations, and with the highest charms of poetry of which modern times can boast—demands and deserves a full and patient investigation of its origin, causes, and institutions.

More difficulties arise in tracing and fixing the period of the origin of chivalry, than would at first be supposed. An institution so singular and striking, which stood forth amidst ignorance, rudeness, and barbarism, distinguished for its refinement and elegance; and which forms the subject, in a greater or less degree, of almost every writer, during the period at which it flourished, it might have been naturally imagined, would have been described, and could therefore have been detected in its infancy. This, however, is not the case. Almost every distinguishing feature of it may indeed be found in the manners and institutions of different nations, and at very early periods; but chivalry, "properly so called, and under the idea of a distinct military order, conferred in the way of investiture, and accompanied with the solemnity of an oath, as described in the old historians and romancers;" is not distinctly mentioned till it evidently had attained its full form, and taken deep and extensive root in almost every part of Europe.

Theories of the origin of chivalry.

In this obscurity and uncertainty of historical record, several theories have been advanced, to account for the origin of chivalry, and to fix the period, and the nation, to which it owes its birth, or at least its full maturity. Warburton, in the *Supplement to Jarvis' Preface* to his translation of Don Quixotte, and in his final note to *Love's Labour Lost*, advances and maintains the hypothesis, which had been previously thrown out by Velasquez, in his *History of Spanish Poetry*, that romance rhime, and knighthood, originated with the Arabians, and through them were introduced, first into Spain, and afterwards into France and the rest of Europe. Mallet, in his *Introduction to the History of Denmark*, sometimes directly maintains the opinion, and in other parts of his work, throws out hints, which lead to the same conclusion that chivalry originated with the Scandinavians. Percy, in his *Reliques of Ancient Poetry*, and Pinkerton, in his *Dissertation on the Goths and Scythians*, mould into a regular and complete hypothesis the opinion of Mallet; the former supporting it with much ingenuity and learning; the latter, in his accustomed manner, with dogmatic authority. Warton, in the first *Dissertation* prefixed to his *History of English Poetry*; and occasionally and incidentally in the third section of the History, offers a modification, or rather an admixture of the hypothesis of Warburton and Mallet, tracing chivalry originally to the East, but deriving it from that quarter, partly through the medium of the Arabians, on their conquest of Spain, and partly through Odin and his followers, when they emigrated from Asia to the north of Europe. Herder, also, in his *Outlines of a Philosophy of the History of Man*, unites and adopts the two hypotheses, and ascribes the life and body which was given to chivalry, as arising from a concurrence of causes, proceeding from "two extremities of the earth," from Arabia through Spain, and from the Normans on their settlement in France. Lastly, a very learned and ingenious writer in the *Monthly Magazine* for February 1800, rejecting all the former hypotheses, considers Armorica, and the connected provinces of Britain, as the countries which gave "the very decisive impulse to the character of modern civilization," by the introduction of romance, rhime, and knighthood.

In order that the respective merits of these different hypotheses may be examined with due candour, and upon sufficient ground, it will be proper to collect and arrange the traces of chivalry, which are to be found in the history of the different countries, from which each hypothesis derives its origin. Thus the whole weight and bearing of authority will be given to the opinions of the writers we have named; and after an attentive and comparative examination, we may be enabled to decide on their respective merits, and probably to throw a new and additional light on this important but obscure subject. Many of the traces of chivalry, which we shall notice and illustrate, have not been even incidentally alluded to, by the authors, whose opinions they confirm; in this respect, therefore, the plan we propose to follow will be useful; while to those who are anxious to investigate the manners of different and distant nations, and by detecting similar opinions and usages among them, to prove their affinity, the enquiry will be interesting and important.

Before entering on this part of the subject, it may be useful to recal to our recollection, what are the distinguishing features of chivalry; viz. a romantic spirit of adventure, and love of arms; courtesy of manners; the point of honour; and a devoted and respectful attachment to the female sex. There are subordinate points, which naturally spring from this pervading spirit; such as a love of the show of war in times of peace, by means of tournaments; a strong and zealous attachment among those who professed chivalry; and the principal and distinguishing ceremonies by which the privileges of knighthood were conferred, and its duties rendered obligatory.

Traces of chivalry in the East.

If we examine into the traces of chivalry in the East, in order to appreciate what degree of plausibility is due to the hypothesis of Warburton, the first circumstance which strikes us, is the frequent mention and description in the poems and romances of the Arabians and Persians, particularly in the *Shah Namè*, of single combats. The persons who engaged in them, like the heroes of chivalry, were armed with complete coats of mail: they had plumed helmets, spears, swords, maces, and shields, and even the dagger, such a principal instrument in all single combats among the knights of chivalry. With respect to their armour, there was only one point in which they differed:—the bow and arrow was never used by European knights, they being confined to the infantry; whereas the Asiatic champions, in addition to the arms already mentioned, had also these weapons. One combat is particularly mentioned by Persian writers, between twelve warriors of Persia and twelve of Tartary; and one of the Persian warriors seems, from his name, to have been a knight errant, as he was known by the appellation of *Reym Khah*, one who goes in search of adventures. Dr Herbelot, also, in his *Bibliotheque Orientale*, under the article *Batthal*, explains it to mean a brave and valiant man, who went in search of adventures, in the same manner as the knight errants of the ancient romances.

In another respect, these combats in the East were very similar to those which formed the glory and principal employment of the knights of chivalry. The Eastern heroes used great precautions to secure themselves from spells and enchantments; and in the West, before the combat began, the champion took an oath, not to carry about him any herb, spell, or enchantment, by which he might procure victory.

On this point of resemblance, Warburton has offered a remark in his final note to *Love's Labour Lost*, which perhaps ought to be considered, rather, however, out of respect to that author's character for learning, than on account of its relevancy and solidity. Of the other illustrations and proofs which he has brought forward in support of his hypothesis of the Eastern origin of romance and chivalry, Mr Tyrwhitt has given a full and satisfactory refutation; the one we are about to cite and consider, has escaped the notice and castigation of that acute writer. "Chivalry, (says Warburton), without a Saracen, was so very lame and imperfect a thing, that even the wooden image which turned round on an axis, and served the knights to try their swords, and break their lances upon, was called by the Italians and Spaniards, *Saricino*, and *Sarazino*, so closely were these two ideas connected.

Now, in the first place, this argument, if well founded, would bring the origin of chivalry down to a period posterior to the Crusades; for till they took place, it is hardly to be supposed that a word borrowed from those against whom the Christians were engaged, would be employed. In illustration of this remark, it may be observed, that *after* the Crusades, the phrase *Jeu Sarrazionois* was in general use, to express any sharp engagement; and allusions to the Saracens became very common in the romances of that period.

In the second place, *Sarazino* was by no means a common name for the image, on which the knights broke their lances; nor were images of men, commonly used for this purpose, (if we may credit the testimony of Matthew Paris), in the early days of chivalry; for that author informs us, that the image of a peacock, the bird served up at the most solemn feasts of chivalry, and by which the most sacred vows were taken, was employed on this occasion.

But lastly, even if we grant that the wooden image was generally called *Sarazino*, this by no means proves the position of Warburton: it is certainly much more natural to suppose, that the name of that enemy against whom the knights in real warfare were to be employed, was given to the wooden image out of contempt or detestation, than that it was thus bestowed, because the institution of chivalry was borrowed from the Saracens.

The traces of the eastern origin of chivalry, besides being derived directly from Arabia and Persia, are supposed to be found in the early periods of Spanish history, immediately after the conquest of that country by the Saracens. But these traces are very indistinct and feeble. The *Moriscoes*, or song romances of Spain, bear but a faint resemblance to the romances of chivalry:—the *Fiestas de los canas* may be compared with more propriety to the Gothic tournaments; but the resemblance is not such as would justify the inference, that the latter was derived from the former.

After all, however, the points of resemblance between the chivalry of the East and the West are very few, and consist in circumstances of the smallest importance, and of the least characteristic peculiarity. A fondness for feats of arms, and amusements which discovered and gratified that fondness, may be traced in the history and romances of the East; but the master spirit of European chivalry, the point of honour, courtesy of manners, and, above all, attentive and respectful gallantry, must not be sought for among the eastern nations.

Traces of chivalry among the Scandinavians.

If we examine the manners and customs of the Scandinavian nations, in order to ascertain what traces and resemblances of chivalry they afford, we shall discover many more of its peculiar features, than the manners and customs of the eastern nations presented. The age at which the Scandinavian youth became their own masters, and authorised to engage in war, and the manner in which this ceremony was performed, coincide with the institutions of chivalry. At the age of fifteen, they were presented with a sword, a buckler, and a lance, and from that period they became members of the state. The heroes of chivalry gave names to their swords;—this, too, was done by the ancient Scandinavian heroes. The following passage, from the Edda, proves that the amusements of the Scandinavians were of the same warlike character as those in which the knights of chivalry engaged: "But tell me, how do the heroes divert themselves when they are not drinking? Every day," replies Har, "as soon as they have drest themselves, they take their arms, and, entering the lists, fight till they cut one another in pieces." And Isidore, in his Chronicle, says, that, in his time, "the Goths were extremely fond of fighting, of handling their arms, and throwing their darts; and that it was their daily practice to divert themselves with mock-fighting."

But as the grand characteristics of chivalry were the points of honour and gallantry united to war, it is necessary to attend to these features in the Scandinavian tribes. Among them, nothing was deemed so insulting as to call a man "niding," or infamous; "for he who had received so deep a stain, without endeavouring to wash it out with the blood of his adversary, would have lost much more than the life he was so desirous to save. Banished by public indignation from the society of men, degraded from his quality of citizen, and scarcely regarded as a human creature, he had nothing left for it, but a shameful and insecure flight:" (*Mallet*, i. 219.) That feeling of honour, which renders life but a secondary object, by making character dearer than life, which marked the age of chivalry, and which has descended from it to modern times, is here strongly and justly painted, as forming a leading and conspicuous feature in the manners and principles of the Scandinavians. Nor were the women less sensible of the value and importance of honour than the men; they were early and regularly taught to despise such as spent their lives in idleness and obscurity;—to prize and reward the valiant, and to shun the cowardly. Such also were the ladies in the age of chivalry.

A delicate and respectful gallantry, even in the days of Tacitus, marked the Gothic nations; and was deemed a necessary appendage, as it was almost always the proof of enterprise and valour. If the knights of chivalry, for the sake of their favourite ladies, went in quest of adventures, and sought victory and renown in foreign lands, and in the midst of difficulty and danger, so also did the Scandinavian heroes. The ode of Regner Lodbrof, so renowned in Scandinavian story, presents us with an instance of gallantry very similar to those which are found in the romances of chivalry, and which we know to have been inculcated by the spirit of that institution. A Swedish princess was forcibly detained by one of her father's captains in an impregnable fortress. He that should rescue the lady, was promised by her father her hand in marriage. Regner undertook and succeeded in the enterprize, and obtained the lady. In the song of chivalry, written by Harold the Valiant, which, as Warton justly observes, has the romantic air of a set of stanzas composed by a provincial Troubadour, he enumerates and describes all the different feats of valour and enterprise, which he had performed for the purpose of obtaining the favour of his mistress.

As respect for the female sex is one of the principal points of resemblance between the manners of the Scandinavian nations and the institutions of chivalry, it may further be remarked, that, according to the testimony of Salvian, the Goths, when they became masters of the Roman provinces, not only abstained from violating the chastity of the women, but, by their example, and the severity of their discipline, rendered the Romans themselves chaste. To protect the chastity of the women was one of the principal articles in the vow that was taken by a knight, when he was admitted into the order of chivalry.

There are still one or two other circumstances of inferior importance, and of a detached nature, by means of which the manners of the Scandinavian tribes may be connected with the institutions and ceremonies of chivalry. When a knight entered on any engagement, to the performance of which he bound himself by a solemn vow, he put chains sometimes on his arm, and sometimes on his foot, which he durst not remove till he had fulfilled his vow, or till he could transfer them to another knight, whom he had overcome in battle or single combat. Tacitus, in his account of the manners of the Germans, relates that the Catti, a tribe of that nation, wore a ring, which they viewed as ignominious, and from which they could not be liberated, till they had distinguished themselves by the slaughter of an enemy.

In the History of Charles and Grymer, Swedish kings, and of Hialmar, the son of Harci, King Biarmland, which evidently describes the manners of Scandinavia during the continuance of the Pagan religion, and in times preceding the tenth century, Hialmar proposes to Grymer to enter into strict brotherly confederacy, which was evidently of the same nature as those fraternities in arms which occur so frequently in the history of chivalry in France and England. Keysler, in his *Antiquitates Septentrionales*, informs us, that the ceremonies used in entering into those fraternities were similar to those employed in the days of chivalry; and the most singular and remarkable of those ceremonies, the admixture of the blood of those who were to compose the brotherhood, is described by Herodotus, as having been usual among the Scythians, the ancestors of the Goths, on the same occasion.

Traces of chivalry in Armorica.

It now remains to examine the manners and institutions of Armorica, in order that we may be enabled to detect in them whatever traces they may exhibit of the features of chivalry. The name of Armorica is supposed to be of Celtic origin, and to signify the country near the sea; for more than 800 years, under that appellation, was comprehended all that part of France which is bounded by the Seine on the east, the Loire on the south, and the sea on the north and the west; including therefore Brittany, the greatest part of Normandy, Maine, Perche, and the northern part of Anjou and of Tourraine. In a more strict and limited sense, however, Armorica comprehended that province of France, which, from the end of the fourth century, was called Brittany.

The inhabitants of this part of France are of Celtic origin; and, in comparing their manners and institutions with those of chivalry, we must therefore have recourse to what we know of the manners and institutions of the Celtic tribes in general, as well as of those of Armorica in particular.

Among the Celtic nations, as well as among those of eastern and northern origin, feats of arms were a regular and honourable employment. The *Oryds* of the Welsh, like the knights of chivalry, rose to that rank through different degrees of honour, and were admitted into it by a ceremony very similar to that which was used in chivalry. They were taught the use of arms; and, like the knights errant, were clothed in green. The gold chain, which has already been noticed in treating of the manners of the Scandinavian nations, was used by the Celtic knights,—but rather as an ornament, and for the purpose of bestowing it as the prize of valour, or the reward of minstrelsy, than as the badge of an unperformed vow. An order of men, similar to the Scalds of the northern nations and the minstrels of chivalry, were educated among the Welsh and the other Celtic tribes, for the purpose of indulging the passions of the *Oryds* for public recitations in rhyme.

These features, however, in the manners of the Celtic tribes, are very general, and by no means sufficient to establish a striking and undisputed resemblance between them and the institutions of chivalry; much less to prove that chivalry originated with the people of Armorica, or the Celtic inhabitants of Wales and Cornwall. There is, however, another circumstance on which the ingenious and learned supporter of this hypothesis rests, in order to establish his position, which, though not immediately connected with our present subject, ought not to be passed over. He contends, and with much felicity and strength of illustration, that the oldest romances of chivalry are of Armorican origin. The steps by which he endeavours to make good his position are, 1st, that all the European nations take their romances of chivalry from the French; 2d, that the French romances originate in the north of France; and, 3d, that the older romances of chivalry have especially celebrated the heroes of Greater or Lesser Brittany, and are therefore of Armorican origin. But it is evident, that it by no means follows, because romances of chivalry are of Armorican origin, that chivalry itself sprung from the same country. This circumstance might strengthen other arguments, but it cannot of itself constitute an irrefragable and conclusive argument. Another position of the same writer is certainly unsupported by fact, and even were it true and well founded, it is not easy to perceive how it could strengthen his hypothesis. In order to prove that chivalry is not Scandinavian, but of Armorican origin, he asserts, that "the whole ritual of chivalry, the military exercises, the fortified palaces, its very religiosity, imply an advanced state in society, to which the Scandinavians could not have attained;" and the obligations of the knight, to which his oath bound him, he considers as the reliques of a receding, rather than the tokens of a growing civilization. This opinion is singular, and seems utterly void of foundation; but were it correct, what proof is there that the people of Armorica exhibited symptoms of a receding civilization, at the time when the people of Scandinavia were only advancing in civilization?

But in the manners and institutions of the Celtic nations, there is no proof of the existence of those peculiar qualities of chivalry:—a high sense of honour, courtesy of manners, and a refined and respectful gallantry; with regard to the latter, the Celtic nations, from every evidence, were far behind the Gothic tribes.

Inferences for fixing the origin of chivalry.

From the preceding investigation into the manners and institutions of the eastern, northern, and Celtic nations, so far as they appeared to bear a resemblance to the manners and institutions of chivalry, several inferences may be drawn, which will be of use in fixing its origin and tracing its causes.

In the first place, the high estimation in which valour was held by the eastern, northern, and Celtic nations, and their fondness for feats of arms, proves neither that these nations sprung from a common stock, nor that either of them gave birth to chivalry. The very constitution and circumstances of society, at the period to which our investigations referred, rendered valour indispensably necessary, and of paramount importance and honour; while the desire of keeping alive and improving their skill in fighting, and the habits they had acquired in actual warfare, naturally gave rise to feats of arms. These features in chivalry, therefore, were rather features of the age, and were exhibited with more prominence by those who had become knights, only because their rank and station in society called for greater skill and courage.

In the second place, the same remark will not apply with equal propriety and force to the more peculiar characteristics of chivalry—a high sense of honour, courtesy of manners, and especially delicate and respectful attention to the female sex. These are not to be found among most nations during that stage of society, in which they appeared among the Gothic tribes. It may be urged, indeed, that the violence and rapine of those barbarous ages required that especial protection should be shewn to the female sex; but this protection would not have been shown, unless their character had previously stood much higher with the men of this nation, than it did among the Greeks, Romans, and the people of the East. Besides, among the Gothic tribes, and in the days of chivalry, the female sex was not merely protected from violence, but they possessed a station of high importance and influence, and were regarded as the most proper and honourable rewarders of that valour, on which the men most highly prided themselves.

In the third place, chivalry, strictly and properly so called, cannot be traced among the institutions of any of the different nations whom we have considered. It nowhere appears as a whole, embodied into form, and infused with an active and animating spirit; the *disjecta membra* may be found, but even these are not complete; nor of that due proportion which they assumed, when chivalry was reduced to a system.

Lastly, in order to gain a clearer insight into the period and the nation that gave rise to chivalry, properly so called, it is necessary carefully to distinguish between a similarity of forms, ceremonies, and amusements, and a similarity in character, and in the nature of the principles and duties of the times, when chivalry actually flourished, and when it is supposed first to have appeared. In this, as in all other questions of antiquarian research, recourse must be had, in the first instance, to direct historical evidence, if it is to be found;—if this does not exist, internal and collateral evidence must be had recourse to, which divides itself into two species; that which consists in the nature of the amusements and ceremonies, and that which consists in the character and habits of nations. On the question of the origin of chivalry, direct historical evidence fails us. Among different nations, very far removed from each other in position, as well as in general habits, we can trace many of the amusements, and some features of the character of chivalry; but these, as has been already observed, were the necessary consequence of the circumstances, in which, at a certain stage of society, almost all nations are placed;—it is only among the people of one tribe, and among them from the earliest notice we possess respecting them, that those characteristics of chivalry, which strike us as the most singular and uncommon, are to be clearly traced.

Still, however, the period when chivalry became a regular and systematic institution remains to be fixed;—that the great principles of it are of Gothic origin, seems to rest on as satisfactory a degree of evidence as the nature of the question will admit; but the state of society among the Goths, at the period when we can trace the peculiar features of chivalry among them, was not such, as either to call for its complete and regular institution, or to enable them to have brought it about. The different periods, which have been assigned to the regular institution of chivalry, are all connected by the authors, who respectively advance and maintain them with some theory on that subject. Those who maintain that chivalry arose out of the feudal system, fix the period of its regular institution after the time of Charlemagne, when that system began to operate most powerfully on the manners and laws of Europe. By other writers, the institution of chivalry is supposed to have been a consequence of the Crusades; and a period subsequent to them is of course assigned to the origin of regular chivalry. Lastly, those who are of opinion, not only that traces of chivalry may be perceived scattered among the manners and institutions of the Scandinavians, but that it existed in a regular and complete form among that people, are disposed naturally to fix the period of its origin prior to the time of Charlemagne.

We shall, in the first place, attend to the evidence on which the opinion of its origin prior to the time of Charlemagne rests; but before examining it, it is necessary to call to mind a position already laid down, viz. that similarity in the peculiar features of chivalry, and not a mere resemblance of a general and uncharacteristic nature, must alone be admitted as relevant and satisfactory evidence.

In describing the manners and customs of the Scandinavian nations, their mode of admitting their young men to the honour and the use of arms was particularly noticed. The advocates for the opinion under examination contend, that this ceremony gradually acquired, long before the time of Charlemagne, all that form and significancy, which it possessed in the most flourishing days of chivalry. It may, therefore, be proper to examine some of the facts on which they build this opinion, since it is of the utmost consequence to distinguish between the ceremonies which attended the investiture of the youth with arms, and his adoption into the order of military men, and those ceremonies with which he was admitted to the rank and privileges, and by which he bound himself to discharge the duties of chivalry.

One of the earliest, best authenticated, and most particular and appropriate instances, is supplied by Cassiodorus. This author informs us, that Theodoric, king of the Ostrogoths, adopted the king of the Heruli, by investing him with a sword, a shield, and other instruments of war; and by presenting him with a horse. A short time afterwards, the Emperor Justinian used similar ceremonies, in adopting Eutharic, the father of Athalaric, king of the same nation. These facts point out the mode used in the 6th century. In the subsequent century, it would appear from a passage in the life of St Eloi by St Owen, that a further advance had been made towards the ceremonies employed in the acknowledged period of chivalry, by distinguishing the knight with ornaments of gold. The passage, however, on which this opinion is grounded,—"non esse dignum, hos qui seculo militarent, incedere *inauratos*," is proved by Mon. de St Palaye, to have been altered in its most important word, since *inornatos*, and not *inauratos* is the original and genuine reading.

It must not be concealed, however, that as we approach the times of Charlemagne, not only do instances of military investiture occur more frequently, but they were attended with much more solemnity and pomp, and with the addition of these ceremonies, which are among the most striking and characteristic of chivalry. Charlemagne sent for his son Louis from Aquitaine, expressly for the purpose of investing him; and at the investiture great splendour and ceremony were used. Similar splendour and ceremony were employed by Louis, when he invested his son Charles. But the instance most to the point, as supplying a decisive proof of the addition of a ceremony very striking in chivalry, is given by Mennenius in the *Reports of Friesland*, as taken from a cotemporary monument, (A. D. 802). Charlemagne, among the other privileges which he granted to that part of his empire, expressly ordained that the governor might make knights, by girding them with a sword, and *giving them a blow*; and this last part of the ceremony is described as customary,—*dato eisdem, sicut consuetudinis est, manu colapho.*

Such is the substance and general bearing and weight of the facts on which the opinion is grounded, that chivalry existed prior to the time of Charlemagne; that it was indeed gradually rendered more perfect in its ceremonies, but that its principle and characteristics were in existence before the reign of that monarch. But, on considering what has been advanced, it will be found to prove merely, that military investiture, a custom existing in a rude form among the Germans at the time of Tacitus, and necessarily arising out of the state and circumstances of society, gradually assumed more splendour, and was attended with additional ceremonies, all indicative of the admission of the person invested, into the rank of military men. But the principal circumstance we shall look for in vain; there is no proof that other duties than those of a purely military character, and of these, only such as the sovereign called for, were undertaken by those who were so invested.

If chivalry existed prior to the regular and full establishment and operation of the feudal system, and was derived, in its perfect state, from the Scandinavians, we should be able to trace it in England before the conquest. On the continent, it may be difficult to determine, whether it owed its origin to the feudal system, or how far that system, co-operating with other antecedent or cotemporary causes, modified and perfected it; because it is not easy to fix the time when the feudal system was in full and regular operation there: but it is well known that in England this system did not exist till the conquest, and that it was introduced and established by William. It is therefore necessary to examine those instances of investiture of which history informs us before the conquest, in order that it may be determined whether they were purely military, or whether in their nature and object they resembled the ceremonies, and were intended to impose the obligations and duties of chivalry. There are only two instances in the Anglo-Saxon period of the English history of investiture. The most ancient occurs in the time of Alfred, and is related by William of Malmesbury: that monarch, struck with the appearance and character of Athelstan, made him a *miles* before the prescribed and usual age, by investing him with a purple garment, a belt adorned with gems, and a Saxon sword with a golden scabbard. In this account there are certainly no traces of chivalry. The investiture was purely military; it had not even many of the ceremonies of chivalry, and does not appear to have imposed any of its peculiar duties. The other instance occurred subsequently, in the time of Edward the Confessor, and is recorded much more fully by Ingulphus. In giving an account of Hereward, who had distinguished himself by his prowess and his victories, he says, that as, notwithstanding the military command he possessed, he had not yet been legally bound with the belt, according to the established custom, he resolved to undergo that ceremony; for it was the custom of the English, (adds Ingulphus,) that whoever meant to be legally consecrated to warfare, should, on the eve of the day appointed for his consecration, confess all his sins to some priest; and afterwards spend the night in the church, in prayer and mortification; on the morrow, after having attended mass, he should offer his sword on the altar, and the gospel being read, the priest should place the sword, having blest it, on the neck of the soldier (*miles*) bestowing on him at the same time, his benediction." Ingulphus concludes this account with observing, that the Normans abominating this mode of consecrating a *miles*, considered the person so consecrated not as a legitimate *miles*, but as a degenerated and slothful knight. The part of the ceremony which the Normans objected to, was that which vested the power of making a *miles* with the priesthood, not the forms which were passed through; and accordingly soon after the establishment of the Norman power in England, the privilege of making knights was virtually, though not expressly taken from that order.

Chivalry supposed to take its rise from the Crusades.

The instance quoted from Ingulphus, is by no means sufficient to prove the existence of chivalry in England before the Conquest. The ceremonies, indeed, are similar, but there is no mention of the duties imposed by chivalry; and what is still more decisive of the question, Ingulphus expressly points out the object and effect of the consecration, viz. that the person so consecrated, might legitimately engage in warfare. Here, then, we have only military investiture, but no traces of the spirit and genius of chivalry. That high regard for their honour, and that refined and enthusiastic gallantry which may be traced in the manners of the Scandinavian nations, was not yet expressly and solemnly incorporated with the love of military enterprise, so common and so necessary to all barbarous nations. The opinion that chivalry took its rise from the Crusades, is advanced by a friend of Bishop Hurd's, in his *Letters on Chivalry and Romance*; and, although no attempt is made to support it, by the evidence of cotemporary authors, yet the ingenuity with which it is maintained, by means of presumptive evidence, renders it deserving of some notice.

The advocate of this opinion supposes, that the restless spirit of the vassals of the Gothic princes, which had been checked and retarded by the Crusades, broke out, when they were no longer engaged in them, in all the extravagancies of knight-errantry. That the warlike and restless genius of the feudatories took this turn, he ascribes to the military fame they had acquired in the Holy Land, and the love and passion of enterprise with which the Crusades had inspired them. "Their late expeditions had given them a turn for roving in quest of adventures; and their religious zeal had infused high notions of piety, justice, and chastity."

"The scene of action being now more confined, they turned themselves from the *world's debate* to private and personal animosities. Chivalry was employed in rescuing humble and faithful vassals from the oppression of petty lords; their women from savage lust; and the hoary heads of hermits (a species of eastern monks much reverenced in the Holy Land,) from rapine and outrage.

"In the mean time, the courts of the feudal sovereigns grew magnificent and polite; and, as the military constitution still subsisted, military merit was to be upheld; but wanting its old objects, it naturally softened into the fictitious images and courtly exercises of war, in *justs* and *tournaments*, where the honour of the ladies supplied the place of zeal for the holy sepulchre; and thus the courtesy of elegant love, but of a wild and fanatic species, as being engrafted on spiritual enthusiasm, came to mix itself with the other characters of the knight-errants."

But this opinion, however plausible, will not bear the test either of argument or authority. Bishop Hurd justly remarks, "that unless the seeds of that spirit, which appeared in the Crusades, had been plentifully sown, and indeed grown up to some maturity in the feudal times preceding that event, it would not have been possible for the western princes to give that politic diversion to their turbulent vassals, which the new hypothesis supposes." And there is undoubted evidence that chivalry, "in its most peculiar and characteristic forms," existed at least as early as the beginning of the eleventh century. Besides, in the accounts which we have of the first Crusades, evident traces are to be found of this institution full formed, and operating with powerful influence on the manners and pursuits of the knights who embarked in it.

Chivalry supposed to arise from the feudal system.

It now remains to consider the opinion of those, who maintain that chivalry was the natural effect of the feudal policy, and who consequently fix its origin at that period, when this policy was in full establishment and complete operation.

The feudal policy may be regarded, either as the cause of the ceremonies and institutions of chivalry only, or of its spirit and characteristic principles. In the former point of view, it would naturally add to the solemnity of military investiture. As, under the feudal system, those lands which belonged to minors were held by the sovereign, till the owner was able to discharge the military duties connected with their possession, the period assigned by law, at which he was deemed capable of defending his land with *complete arms*, or with those which a knight was entitled to wear, and at which the sovereign resigned it with his possession, would naturally be celebrated with great pomp and solemnity.

But the influence of the feudal system in giving form and spirit to the institutions of chivalry, was much more conspicuous and important. That passion for military adventure, which may be traced in almost every nation, at a certain stage of their progress towards civilization, would be much increased by the principles and effects of the feudal system. The territory each noble possessed had been gained by the sword; the acknowledgment he paid for it, was the employment of his sword in the service of his sovereign; and by the same means alone, could it be defended from the attacks of his restless and powerful neighbours. Much of his time, therefore, must have been taken up in actual warfare; and what was not thus employed, was naturally devoted to those amusements, which would increase his military skill, and which bore the semblance of war.

That high sense of honour, and that pride in redressing wrongs and removing grievances, which distinguished the Scandinavian nations, would have ample scope during the violence, rapine, and plunder of the feudal state; while the attentive and respectful gallantry which was equally conspicuous among them, would be cherished and called into constant exercise in the castles of the barons, amidst the free commerce and conversation of the ladies. The religious character which distinguished chivalry, arose out of the manners of the times and the state of society, and therefore need not be traced to any particular and predominating cause.

The only author who regards the feudal system as absolutely hostile to chivalry, is Pinkerton; but as his opinion is not supported either by authority or argument, it cannot be expected to outweigh the reasons, which have been brought forward to prove that this system, though it did not actually give birth to chivalry, was very instrumental in bringing it to maturity.

Objections to the different theories of chivalry.

To sum up the grand inference from the investigation which has been gone into, and the train of reasoning which has been pursued. The theories respecting the origin of chivalry, which were enumerated in the beginning of this article, evidently confound two things, quite distinct in their nature and character. That theory which would seek the origin of chivalry among the nations of the East, overlooking that nice regard to honour, that courtesy of manners, and that respectful and delicate gallantry, which formed its characteristic features, insists only on that resemblance between the knights of chivalry and the warriors of the East, which consists in their common passion for war, enterprize, and adventure. In this theory, therefore, the natural result of a certain stage of society is confounded with a regular institution, existing certainly in a stage of society nearly similar, and therefore embracing its features, but also superadding many regulations, and exhibiting many points of character, utterly inconsistent with the manners, the feelings, and the institutions of the East.

That theory, which ascribes the origin of chivalry to the Scandinavian nations, approaches nearer the truth. It can trace among them not merely the love of warfare, enterprize, and adventure, and a high estimation of personal valour, but also a nice regard to honour, and a respectful and delicate attention to the female sex. But these qualities existed generally; they were not the peculiar characteristic, nor regarded as the especial obligation of a certain portion of the community. In short, among the Scandinavians, almost every feature that afterwards composed chivalry may be traced; but they were not among them, as when it was established, arranged in their regular order, and with their due proportion.

It only remains to notice the theory, which considers chivalry as of Armorican origin. Among the Celtic tribes, there is no evidence of that high regard to honour, and the female sex, which has been so often stated as the characteristics of chivalry. This theory, therefore, is not built on such strong presumptive evidence as that which refers it to a Scandinavian origin.

Those authors who regard the examples of military investiture, during or before the reign of Charlemagne, as proofs of the existence of chivalry at that early period, likewise confound two things quite distinct in their nature and character. By the military investiture, the right of carrying arms, and engaging in warfare alone, was bestowed; and there does not appear to have been any other obligation imposed, but that of employing the arms, with which the soldier was invested in the service, and for the protection of his sovereign. Although, therefore, the spirit of chivalry was drawn from the love of military enterprize, which is common to all nations at a certain period of their age, and from that nice susceptibility of honour, and high estimation of the female sex, which were peculiar to the Scandinavian tribes; and though the ceremonies of chivalry were borrowed from those employed on occasions of military investiture, yet these facts are by no means sufficient to warrant the conclusion, that it derived its origin from any of these sources.

Origin of chivalry.

Chivalry, properly so called, as has been already observed, cannot be traced further back than the eleventh century. In the beginning of that century, the rudiments of the laws of chivalry may be found in the decisions of the famous Council of Clermont. About the year 1025, several prelates, and particularly the Archbishop of Bourges, drew up a set of laws for the maintenance of order, and the protection of the weak; which were afterwards submitted to, and confirmed by, the Council of Clermont. These laws every person of noble birth, when he had attained the age of twelve years, was obliged to submit himself to, by swearing to their observance before the bishop of his diocese. By the oath which he then took, he bound himself to defend and protect the oppressed, the widows, and orphans; to take under his especial care married and unmarried women of noble birth; and to use his utmost endeavours to render travelling safe, and to destroy tyranny. Hence arose, as Boullainvilliers observes, in his *History of the Ancient Government of France*, the order and the laws of chivalry, and the honour attached to the name of knight. That the laws established by the Council of Clermont formed the rudiments of those laws, to which every person submitted himself when he became a knight, is sufficiently evident from the summary of the latter, which is given in the work entitled, *Ordre de Chevalerie*, as quoted by Monsieur de Sainte Palaye, *Office de chevalier est de maintenir femmes, veuves, et orphelins, et hommes misaisés et non puissans.*

Spain and France appear to have been the countries in which chivalry was first regularly formed into a system, and where it flourished in its greatest splendour, magnificence, and purity. The natural character of the Spanish nation; the necessity in which they were placed of exercising constant activity and enterprize, to secure themselves from their infidel invaders; and the frequent opportunities and occasions for protecting and avenging the weak and defenceless, to which the state of their country for many centuries gave birth; all conspired to the early establishment of chivalry among them. In France, the magnificence in which the barons lived, the pervading influence of the feudal system, which then was on a most sumptuous, extensive, and lasting footing; and the regular institution of schools in the castles of the nobility, for initiating their youth into the rules and practices of chivalry, contributed to the same effect.

Germany, also, was an early seat of chivalry, and produced many knights, who practised it with the greatest zeal, and in its utmost strictness and purity. In England, it was rather of later birth and slower growth; nor till the intercourse between this country and France became familiar and frequent, were the English knights of great celebrity.

Institutions of chivalry.

We shall now proceed to give an account of the institutions of chivalry; of the education by which the young nobility were trained up to the duties and the honours of knighthood; of the degrees through which each candidate for these honours was obliged to pass; of the ceremonies that were employed in making a knight; of the armour which he was allowed or expected to wear; of the rights and privileges with which he was invested; of the duties and virtues which he was called upon to practise; of the feats of arms in which he employed his leisure, and indulged his passion for actual warfare; of his amusements when not thus engaged; of the causes and ceremonies of his degradation from knighthood; of the manner in which his old age, when he was no longer fit for activity and enterprize, was spent; and of the ceremonies and honours attendant on his funeral.

Those extravagancies of chivalry, knight-errantry, and the fraternities or brotherhoods, which proceeded from the passion for adventure and enterprise, and from romantic and fanatical ideas of love and gallantry, will also be noticed and described.

As the character and influence of the female sex were so very prominent and predominating in the age of chivalry, the education which they received, the part which they performed in calling forth and rewarding the virtue of knighthood, and their general manners, habits, and employments, will be cursorily touched upon.

Lastly, the period and causes of the decline and extinction of chivalry, and the impression which it has left on the character of modern times, and on our mode and principles of intercourse with one another, will naturally form the subject of the concluding part of this article.

Education of the young nobility.

Till the age of seven years, children of a royal or noble birth, by a custom which appears to have been followed in the time of the Emperor Julian, and which continued in France till the Revolution, were entirely committed to the management and charge of the women. When they had attained that age, such as were destined for chivalry entered on that course of education, which was to prepare them for the enjoyment of its honours, and the performance of its duties. The scene of this education was either the castle of their father, of some of their relations, or of a neighbouring noble: in most cases the last was preferred, especially if in it were to be found youths of the same age, and preparing for the same object. It was not considered degrading for the most noble youths to receive their education and their maintenance from those who were not related to them: on the contrary, as they necessarily discharged certain offices of the household, in order to prepare themselves for the ranks of knighthood, the obligation was deemed mutual.

The appellation that was given to these youths from the age of seven to that of fourteen, was that of *Pages*, *Varlets*, or *Damoiseaux*: in our old English ballads and romances, *Child* was a common name for them. These appellations, however, were sometimes applied to those who had reached the higher rank of *Esquire*.

The pages were kept in constant and active employment: they waited on the master and mistress of the castle, both at home and abroad; during their journeys, their visits, their walks, and even at the chace, it was the duty of the pages to be in attendance. They even waited at table, and acted in the capacity of cup-bearers. The renowned chevalier Bayard, in his early youth, was placed in the house of his uncle, the Bishop of Grenoble; and, we are told, that when the latter paid a visit to the Duke of Savoy, he was accompanied by Bayard, who attended upon him at dinner.

The first impression that was made on the minds and feelings of the pages, were those of love, gallantry, honour, and bravery. Surrounded by noble ladies and valiant knights, the instructions they received, and the examples that were displayed before them, all had this tendency. Chivalry they were taught to reverence, as containing every thing that was alluring, grand, and desirable: and the only means by which they could gain this object, they easily and early perceived were those of devotion to the female sex, and skill and courage in warfare.

They were taught, at the same time, by the ladies of the castle, the rudiments of religion and of love. *The love of God and of the Ladies* was constantly impressed on their minds:—it was the first lesson they received. In order that they might have opportunities to practise, in some degree, the instructions they received, it was customary for each youth to select some young, accomplished, and virtuous lady; at her feet he displayed all his gallantry; to her he disclosed all his thoughts; her he made the judge of all his actions. She was authorised and called upon by him to polish his manners, and to render him fit for the softer and more elegant duties of chivalry.

The emulation natural to youth; the martial sports and exercises which they daily witnessed; the discourses of war and of feats of arms which they heard from their master and his guests, all conspired to give them a passion for the sterner and more laborious duties of chivalry. The sports in which the pages employed and amused themselves, were of a military nature: unable, from their extreme youth, to hurl the lance, they gradually trained themselves up to that exercise, by throwing the dart; their hoods (*chaperons*) they used as helmets; and, in short, by every method in their power, exhibited and fulfilled their desire of becoming expert warriors.

Degrees through which the candidate for knighthood passed.

In this manner was their time spent, till they reached the age of fourteen years: when they passed from the care of the women into the rank of pages, no ceremony was deemed necessary; but their introduction into the rank of esquire was thought to require some solemnity. Now, for the first time, arms were about to be placed in their hands; they were about to have a foretaste of those honours and dignities, surrounded by which they had passed the last seven years of their life. The ceremonies used at the introduction of the page to the rank of esquire, were very similar to those employed at the military investiture which have already been described, and noticed, as having been confounded with those of perfect chivalry.

As soon as the youth had reached his fourteenth year, he was led to the altar by his father and mother, each carrying a wax taper in their hands. The officiating priest took from the altar a sword and belt, which, having previously bestowed his benediction on them, he fastened to the side of the youth, who, from that moment, was authorised to carry arms.

The esquires, the second degree of rank, consisted of several classes and departments, each of which had their respective duties and employments: there were esquires of the body, who were attached to the person, first of the lady, and afterwards of the lord; esquires of the chamber; esquires of the stable; and carving esquires;—besides these, the inferior departments of the household, such as the wine cellar, and the pantry, had their respective esquires.

The highest rank was that of esquire of the body, who was also called the esquire of honour: he was in constant and close attendance on his master, especially in times of difficulty and peril: he carried his banner when he went into battle, and sounded his *cry at arms*. It was also his office to dress and undress him. As a knight always was attached to some lady, his messages of love and gallantry, and the care of his interest when he was occasionally absent, were committed to this esquire.

But before the youth could expect to attain to this high rank, it was necessary that he should perform many inferior offices, and learn the preliminary and intermediate duties. These consisted in receiving with hospitality, and waiting upon with diligence and zeal, the guests who came to his master's castle;—in listening in silence to the conversation of those who were of superior rank, and in displaying, on all occasions, modesty, diffidence, and attention. The first employment of the esquire seems to have been at the table, where he was expected to display the qualities proper for his station, in the neatness, adroitness, and dispatch with which he cut the meat, and in the ease and elegance with which he served it to the guests.

It was the business of other esquires to arrange the table; to bring in water with which the guests might wash themselves after the repast was over; to take care that every thing was replaced in its proper order and situation; and to arrange the grand hall for the dances and amusements with which the evening generally closed. When bed-time came, some of the esquires accompanied the strangers to their rooms; and according to the evidence of some of the romances, they were even employed to make the beds.

It is plain, from this account of the duties of this class of the esquires, that their rank was not high: how long they continued thus employed is not known; but the next step in dignity was that of squire of the stable. The duties of this office were much more important, and required a considerable degree of skill and experience. As their name implies, they had the care of the horses; with the assistance of inferior esquires, they trained them up to war, and taught them all the paces and movements that were necessary in tournaments or in battle; they also kept their master's arms constantly clean and ready for use.

But it was when their master prepared to go forth arrayed for battle, or for feats of arms, that the esquires were all in active employment: while one held the stirrup as he was mounting his horse, others brought him the different parts of his armour, and his pennon or banner. As it was not customary for a knight to ride on his war-horse, except when an enemy was in sight, or in actual battle, one of his esquires led it by his side, and gave it him when requisite; another generally preceded him, mounted on a common horse, carrying his shield and his helmet on the pommel of his saddle. Whenever it was necessary that the knight should mount his war-horse, and equip himself in full armour, each esquire performed his allotted duty in fitting on, with skill and expedition, the different parts. When the knight entered a church or any holy place, he took off his helmet and his sword, and gave them into the hands of the esquire of honour.

In the time of battle or of single combat, it was the duty of this esquire to watch all the movements of his master, in order that he might profit by what he saw, and that he might be ready to give him fresh arms or a fresh horse if he required it. It was also lawful for the esquire to ward off the blows that were aimed at him; to point out how he might attack or defend himself with success and advantage; and, if victorious, how he might render his victory complete. The knights, likewise, gave the prisoners whom they took in battle into the custody of their esquires.

The watchfulness and precaution so necessary in the feudal times, were carefully and early taught the esquires; the castles which they inhabited were guarded by them in all their different parts: they were stationed on the towers, in order to give the alarm in case of the approach of an enemy; and they regularly traversed and examined all the chambers and courts.

Thus the time of the esquire was spent, from the age of fourteen to that of twenty-one; for it was not, in general, till the latter period, that he was admitted to the full honours of chivalry. The cases in which this regulation, with respect to age, were dispensed with, were where the youths were of royal blood, or where their merit was very conspicuous and pre-eminent. There are examples of esquires having been made knights at the age of sixteen, fifteen, and fourteen; but even in cases of noble birth, fifteen seems to have been the earliest legitimate age, since the sovereign could not levy the *aids of chivalry*, for the purpose of defraying the expense of making his son a knight, till that son had attained this age.*

Every person who was a knight could confer the honours of knighthood. Some authors maintain, that prelates and ladies had also the privilege of knighting, but this opinion is unfounded. It has been already noticed, that military investiture was originally conferred in England and on the continent by the hands of the priests; and this ceremony having been confounded with that of knighthood, has given rise to this idea. In the same manner, the initiation of the page into the rank of esquire, admitting of the presence and participation either of his father or his mother, it has been erroneously supposed that ladies could confer knighthood. There is, however, one instance of knighthood having been conferred by a lady, though, from the singularity of the circumstance, it must be regarded as of doubtful authority. Menard, in his *Life of the Constable Du Guesclin*, relates, that his widow girt Andrew de la Val, afterwards Marshal of France, with the sword of her husband, and *made him a knight*.

Whoever appeared to receive the honours of knighthood, was to be of conspicuous merit, of sufficient estate to support the dignity, and, according to the regulations of chivalry in Germany, of three noble descents by the father's side.† No person who was lame, or who laboured under any disorder which disqualified him for warfare, however rich or noble he might be, could be made a knight.

Such were the general regulations with respect to those whom it was lawful to admit to the full honours of chivalry; but there were exceptions. Monsieur de Querlon, in his *Memoire sur la Chanson*, gives many instances of trombadours, who followed their masters to the wars, having been knighted; and we have the testimony of Glanville, that in England, during the reign of Henry II. enfranchised villains, born in servitude, were sometimes knighted.

Esquires were raised to the rank of knights either in time of peace or war; the ceremonies usual during the latter were comparatively simple and short; those employed in times of peace were minute, solemn, splendid, and magnificent. The occasions on which knighthood was most commonly conferred, during peace, were the high feasts of the church, especially Pentecost; the proclaiming of peace, or a truce; the coronation of kings; the birth and baptisms of the royal family; the days when princes themselves were made knights; on their marriages; and at tournaments.

Ceremonies employed in making a knight.

The esquire prepared himself for the honour he was about to receive, by rigid fasting, and passing the night in prayers, along with the priest and his sponsors, in a church, where his arms were hung up. As a type of the purity of manners which would be required of him, he clothed himself in white, after having performed his ablutions in a bath. A full and solemn confession of his sins, a serious attention to a discourse, in which the duties of chivalry, and the articles of his religious faith, were detailed and enforced, completed the preliminary part of the ceremony. When this was performed, he again entered the church with his sword slung on his shoulder; taking it off, he presented it to the priest, who consecrated it, and returned it to him; immediately after this the novice received the communion; then with clasped hands he threw himself on his knees before the person, who was to confer the honour of knighthood, and delivered him his sword. A number of questions were put to him: he was asked, What were his views and motives in entering on the order of chivalry? Whether he had any object but the maintenance of its honour, and the support of religion? If his replies were satisfactory, the efficient and final ceremonies began. The novice received from the hands of the knights—sometimes from those of the ladies—all the insignia of chivalry. One approached him, and put on his spurs; in ancient times putting on the left spur first; afterwards the custom was changed, and the right spur was put on first. After his spurs were put on, another knight or lady clothed him in his coat of mail, his cuirass, and the other parts of his armour. The last thing that was given him, was his sword; this was deemed the most essential part of the ceremony. He was *dubbed* (*adoubé*)‡ in this manner, still continuing on his knees. The person who confirmed the order, then rose from his seat, approached the novice, and bestowed on him the *accolade*; this consisted, generally, of three blows with the flat side of the naked sword on the shoulder, or on the neck of the novice; sometimes it was bestowed by a blow with the palm of the hand on the cheek. The meaning of the *accolade* has been differently interpreted; some regard it "as an emblem of the last affront which it was lawful for him to endure;" others as borrowed from the mode which the Romans practised, when they manumitted their slaves; and others as a warning of the difficulties and dangers, to which, in the discharge of the duties he had undertaken, he would necessarily be exposed. When the *accolade* was bestowed, the person conferring the order pronounced him a knight in the name of God, of St George, and of St Michael the archangel; sometimes counselling him to be brave, undaunted, and loyal. When he leaves the church, or the place where the ceremony has been performed, a horse is brought him, which he mounts, and with drawn sword and brandished lance, exhibits himself fully equipped, in the most frequented and public part of the village. As soon as he is recognised by the populace, they shout and dance around him, thus proclaiming their joy at having acquired a new protector. When several were made knights at the same time, it was usual for them to make their horses prance, and wheel in *time* with the dances of the populace. This M. de St Palaye supposes to have been the origin of the *fetes* or *ballets à cheval*, which were common at the French court, even in the time of Brantome.§

There was some variation in these ceremonies at different periods, and in different countries. On occasions of simple military investiture, and probably also in the ruder ages of chivalry, the person who officiated kissed the new knight on the left cheek, when he gave him the belt; this was called the kiss of peace. Afterwards, an embrace was given instead of the kiss; and from this circumstance, the term *accolade* is evidently borrowed. In Spain, the kiss and blow were sometimes given, with these words, "Awake, and sleep not in affairs of knighthood," or, "God assist you in the performance of your promise." Sometimes, out of honour to the person knighted, as in the case of the Cid, the blow was omitted; and sometimes the blow only was given. In time of war and actual service, the occasions and opportunities for conferring the order of chivalry were very frequent and numerous. When the army entered on hostile territory, during their march, and even sometimes during their retreat; when it was necessary to force the passage of a river or bridge, before an assault or battle, and at their termination, the honour of knighthood was conferred on many esquires. It was a point much discussed among knights, and in books of chivalry, whether it was more proper and more honourable to confer knighthood before battle or after it: if it were conferred before battle, it served to rouse and animate the courage of the new knight, who was always placed in the front rank, or in the post of danger, and who considered himself bound to prove that he was worthy of the promotion that he had received. But as it happened, sometimes, that the battle, on the supposed eve of which the knights were made, did not take place, the honour was conferred on those, who neither had distinguished themselves, nor had an opportunity of doing so.* Brantome therefore, and other valiant and experienced chevaliers, were of opinion, that the honour should be conferred after the battle, when the esquire had shewn himself worthy of obtaining it, and when no circumstance could take place, which could make him be regarded by his fellow knights as a person of untried valour and merit.

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* There were four cases, in which a sovereign or knight could raise the *aids of chivalry* on his subjects or vassals; that mentioned in the text, the marriage of his daughters, the payment of his own ransom, and the expense of any enterprise beyond sea.

† By an old law of France, if any man, not noble by his father, though he was by his mother's side, had been made a knight, he might be degraded, by having his spurs cut off on a dunghill. (Selden's *Titles of Honour*, Part II. c. iii.)

It would appear, from a passage in Froissart, where he mentions the knights that were made by the King of England in 1359, at the attack on the palisades of Paris, that a helmet was a necessary piece of armour in the creating of a knight, since the King, who wished to include his esquire of honour in the promotion, could not do it, because the esquire could not find his helmet.

‡ This word is evidently derived from the Teutonic *doopen*, to dip, and must have been borrowed from the ceremony of bathing.

§ The rejoicings and amusements, which took place when the order of chivalry was conferred, and which, in the old historians, are denominated *festum tyrocinii*, lasted many days; where the person admitted was of high rank, tournaments were held.

The ceremony during war, was very short and simple; the person to be knighted, presented his sword to the person who was to bestow the honour, who returned it to him, giving him at the same time the accolade. Although this was esteemed the most honourable knighthood, yet it is doubtful, whether the rights and privileges conferred, were not merely personal; and it is certain, that no obligation to take the oath was imposed or necessarily implied.

When the honour of knighthood was bestowed by a sovereign, or noble of high rank and great wealth, it was always accompanied with valuable presents; and in every case, robes of great splendour were bestowed on the new chevalier. When it happened, that he had not fortune adequate to the proper support of his dignity, the sovereign assigned him a sufficient revenue of money or lands.

Equipments of the knights.

Horses.

The most important part of the equipments of the knight, was his horse: of this animal he had different kinds; the great horse, or war horse, was employed only in actual battle or in feats of arms.† As the knight, when fully equipped, was a great weight, it was necessary that this kind of horse should be very strong. All horses which exceeded the size of six hands and four fingers were deemed *great* or *war* horses. These horses were caparisoned with great splendour, and ornamented with housing and saddle cloths, embroidered with different colours, and exhibiting the coat of arms and the *tincture* of their riders. In the time of Henry I. the war horses appear not to have been protected with any armour; but in the reign of Richard I., and subsequently, they were covered with a coat of mail, interwoven with iron rings, sewed together with thread; these horses, when so armed, were called *barded* horses. As it was against the laws of chivalry to strike a horse at a tournament, the war horses, on these occasions, were covered only with silk or velvet *bards*, embroidered with armorial bearings. Sometimes, also, in tournaments, and even when travelling on his palfrey, the knight ornamented the crupper and other parts of the harness with little bells. The common gait of horses, used in tilting, was that called *ambling*, and they were taught this action by the shoes on the hinder feet having a long point projecting from the toe. Besides the great horse, the chevalier had his palfrey, his courser, and his bat horse. The palfrey, as has been already stated, he rode on, while proceeding to the battle or tournament; the courser was employed, where expedition was required, either in affairs of gallantry, or war; and his bat horse was designed for carrying such of his arms as were not committed to the charge of his esquire: these generally consisted of a second lance, shield, &c. in case of accident; the bat horse also carried what little baggage the knight took with him, and was occasionally mounted by one of the esquires.

Arms.

It was deemed dishonourable for a knight to ride on a work horse, or a mare; and one mode of degrading him was to deprive him of his war horse, and oblige him to ride on a work horse; no other knight would tilt with, or even address one so mounted. A knight was also dishonoured by being seen riding in any carriage drawn by these common horses. In the days of chivalry, the horses that were rode by knights, whether war horses, palfreys, or coursers, were all *entire*. The offensive arms of the knight consisted of a lance, sword, dagger, battle axe, and maces of different kinds; sometimes he fought with heavy clubs of iron; but the *lance* was his distinguishing weapon; it was longer than the lance now in use, and resembled that of the Polish cavalry. It was strong and difficult to be broken, and commonly made of the lime, aspen, or ash: the last kind of wood was preferred. The lances that were used in tilting, had blunt heads, or with a *coronel* on them: the staves were thick at the but end, near which they had a cavity for the hand; at the point a *banderolle* or *pennon* was fixed. Originally the shaft was plain, but afterwards fluted. As in tilting the knights sometimes dismounted and fought on foot, in these cases, they broke the shaft of their lances, in order that, by shortening it, they might have more command over it, in thrusting at their adversary. The sword used by the knights of Germany was longer than that generally used by the knights of France; and the former country, in the time of Joinville, was famous for this weapon. There was a particular kind of sword called *braquemart*, that was short, strong, and blunt at the point. In the reign of Saint Louis, King of France, the point was sharpened. The handle of the sword was in the form of a cross, and the name of Jesus was frequently inscribed on this part of it, so that when a knight swore by his sword, his usual oath, he swore by his religion, as well as by his valour. The dagger worn by a knight, called by the French writers *misericorde*, or the poignard of mercy, was used only in close and desperate struggles, when the combatants, unhorsed, and so near to each other, that they could not use their other weapons, were obliged to have recourse to these. It was also employed to dispatch the vanquished knight, unless he cried for mercy. It was commonly worn in the bosom.

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* Tillet relates, that at Kioufosse, in 1339, when the hostile armies were drawn up, several knights were made, in expectation of instant battle. The battle, however, did not take place; and a hare running along the line, during the ceremony, the new made knights, were called, in derision, *Knights of the Hare.* (Tillet, quoted by St Palaye, I 253.)

† This kind of horse is called by the Latin writers, *dextrarius*; by the French, *destrier*. It is generally supposed, that it took this name from the circumstance of its having been well trained for the purposes of war and chivalry, by the hand, (*dextra*). But St Palaye is disposed to derive the appellation from another cause. When the knight was not in actual battle or combat, he was mounted on his palfrey, while his esquire led his war horse in his *right* hand.

Armour.

The principal parts of his defensive armour were the helmet and bacinet, the coats of mail of different kinds, and the shield. The helmet was made with holes for breathing and seeing; and it was of the utmost importance, that the esquire should take care that the rivetting of the top of the cuirass, and of the helmet, should be firmly done, before a battle or tournament, since otherwise it might happen, that, by a violent blow, the helmet might be turned with the wrong side foremost. This happened to a French chevalier at the battle of Bouines; and the fatal accident which deprived Henry II. of his life, is supposed to have originated from some negligence in this respect. The crest of the helmet, called by the knights of romance *le plus haut de ses biens*, was ornamented with *lambrequins*, the favours which their mistresses had bestowed on them, and frequently with the images of some fancied monster. The bacinet was a light kind of helmet, so called from its resemblance to a *bason*; this the knight, when fatigued, put on instead of his helmet. Sometimes a kind of cap was fastened to the lower part of the crest of the helmet with ribbands; this cap was composed of thin plates of iron, and was put on, when the knight took off his helmet for the purpose of breathing more freely; in this case, the ribbands which had fastened it to the crest, flowed down on his shoulders, whence they had the name of *volets*.

Coats of mail consisted either of chain or plate armour; the latter were more ancient and more common, having been used in France very early in the days of chivalry. The haubert, haubergeon, or hauberk, as it was indiscriminately called,* was composed of double plates, or scollops of steel, impenetrable to any arrow or lance. It covered the body completely from head to foot. This kind of defensive armour was allowed only to the knights. The hauberk of the simple esquire was distinguished, by its being without hood and hose. The cuirass, which came into use long after the coat of mail, consisted of two parts: a back and a breast piece of iron, fastened with straps, and covering the body completely before and behind; it was much more heavy and cumbersome than the coat of mail. It was reckoned as dishonourable for a knight to quit his cuirass or coat of mail, as for a Greek or Roman to lose their shield. Of the shield it it is not necessary to give any description.

The armour which was used in tournaments, was much lighter, and more ornamented than that employed in battle: "The helmet was perforated only on the right side; the left side of the face, and the left shoulder and breast, were covered with a plate called a grand guard, which was fastened on at the stomach. On each shoulder was also fixed a plate, declining from the face like wings, in order to protect the eyes from the point of the lance: these were called *pass-guards*. From the right side of the cuirass a moveable bracket projected, called the *rest*, for the purpose of supporting the lance." Grose on *Ancient Armour*.

Privileges of the knights.

One of the first privileges which the knight received was, that of bearing a coat of arms. Coats of arms, in a more loose and extended sense, are very ancient; they are assigned by Eschylus to the warriors against Thebes; but these were of a very different kind, and destined for a very different purpose. The coats of arms used in chivalry were fixed and certain; their purpose to distinguish families. The coats of arms mentioned by Eschylus were frequently changed, and, indeed, were merely temporary, being used only in battle to distinguish friends from foes. There is much difference of opinion respecting the time when armorial bearings, properly so called, were first used. The circumstance of their not appearing on seals till about the eleventh century, has induced many authors to fix their introduction at that period. But the fact will by no means bear out the inference; besides, that if we may credit Uredius, in his Treatise on the Seals of the Counts of Flanders, a coat of arms is to be seen on the seal of Arnulphus, the great Earl of Flanders, in the year 941. But the mode in which figures on seals were for a long time represented, prevented the coat of arms from being seen; as the horseman, on the more ancient seals, appears riding towards the sinister side of the seal, commonly bearing on his left arm a shield cast back in such a manner, that the concave side alone is visible. Now, for a long time the upper side was the only part where the coat of arms was painted. That this is the cause why armorial bearings are not visible on ancient seals, is evident from this circumstance:—that as soon as the position of the horseman on the seal was changed, they became apparent. The fashion altered soon after the reign of Henry I. The most ancient English seal, with arms on it, is that of Richard I.

But to return from this digression. The sovereign or noble who bestowed the honour of knighthood, encouraged or permitted the newly made knight to assume the whole or part of his arms; sometimes, but very seldom, he assumed the entire armorial bearings; more frequently, he incorporated part of them with his own coat of arms. He in his turn transmitted the whole, or part of his armorial bearings, to the knights whom he created; whence the resemblance in different parts of the coats of arms of families not allied, which existed in the days of chivalry.

Many knights, however, refused to assume any armorial bearings, till they had won them by their merit or their valour; or, if their shield was adorned with the armorial bearings of their family, they carefully and modestly covered it over, till they had acquired celebrity in war or tournaments. It not unfrequently happened, that the strokes of the sword or the lance cut off the covering from their shields, and displayed at once the family and the merit of the newly made chevalier. Sometimes he exhibited a shield painted white, or of any other uniform colour throughout, and anxiously waited till an opportunity of displaying his valour might give him a right to inscribe armorial bearings on it. If he was so unfortunate as to be defeated in combat or in battle before he had assumed his coat of arms, he preferred death to the disgrace of making himself known. In the romances there are many examples of this sort; and that the authors of these romances copied from the actual practice of chevaliers, appears from the undoubted testimony of a chronicler quoted by St Palaye.†

The new made knight generally carried a white shield,

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* According to some authors, the haubergeon differed from the haubert, in being without sleeves.

† St Palaye, i. p. 348.

Chivalry.
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unadorned with armorial bearings, for the space of a year, unless some opportunity occurred before that period of signalizing himself in battle. If he had fought against the Infidels, he assumed a cross as part of his arms; if he excelled in the management of the lance or the sword, he added these; had he forced a barrier or a castle, these also were assumed; and in several instances, the wounds which he had received, were pictured in different modes on his blasonry. The head of the lance was very commonly adopted; and from this circumstance, according to St Palaye, the fleur-de-lys of France takes its origin.[*]

Another privilege bestowed by chivalry, immediately connected with, and indeed necessarily resulting from, that of armorial bearings, consisted in the new knight being authorised to make use of a seal. A passage is quoted by Selden from an old chronicle, in which it is expressly stated that Richard, Earl of Chester, in the reign of Henry I., when he conveyed his lands in Weymonsley to the Abbey of Abingdon, made use of his mother's seal, because he had not yet arrived at the honour of knighthood, (*nondum enim militare balthio cinctus erat,*) and St Palaye and Boullainvilliers (*Histoire de l'Ancien Gouvernment de France,* i. 326,) maintain the same opinion. Yet that in England, seals might be used even by inferior persons, appears from a passage from Ingulphus, quoted by Selden, and another from Glanville, given by the same author. Du Tillet also cites a judgment as old as the year 1366, in which an esquire is said to *change his seal* when he attains the rank of knight.

It is probable, however, that to wear seals with armorial bearings on them, was the exclusive privilege of a knight; and that the seals mentioned by Ingulphus and Glanville, and the judgment cited by Du Tillet, refer to seals without armorial bearings; since it is undoubted, that esquires, and men of inferior birth, were not permitted the use of coats of arms. A knight, beside a large seal which he employed on grand and important occasions, had generally one or more seal-rings on his finger; and the possession of these was deemed so sure a mark of his delegated authority, that his vassals yielded implicit obedience to whoever displayed them.[†]

The knight was also privileged in the dress he wore, and in the ornaments by which it was distinguished. On the day of his knighthood, he received from his sovereign a splendid mantle, which completely covered his person, and swept the ground with a long train. This, which was called the king's livery, and which was renewed regularly twice a year in winter and summer, as well as at grand feats or tournaments, was lined with the most costly furs, and adorned with gold. No person of rank inferior to that of a knight, durst presume to wear gold, fur, or silk. Gold, as the most precious metal, was reserved for their use: it formed or covered their spurs, and adorned the trappings of their horses, as well as their own robes. If the chevalier appeared in the rich and splendid silk of Damascus, the esquire was clothed in satin; and if the latter was dressed in the silk of Damascus, the chevalier was clothed in velvet. Scarlet, or some other colour partaking of red, was appropriated to the knight, and no inferior person durst presume to appear in any colour at all resembling it.[‡]

But the knight possessed rights and privileges of a higher nature, and more dignified importance. Such was the estimation in which knighthood was held, that for a long time no sovereign could be crowned till he had been knighted; and the son of a king was scarcely permitted to approach the person of his father, certainly not to sit down to table with him, previous to his being invested with the order of chivalry. Birth, however illustrious and noble, bestowed no personal rank, till to it had been added the title of knight. While the rank was only that of esquire, even the son of a king was considered as the servant of the knight in whose family he resided; and, till he became an esquire, he was looked upon as belonging entirely to the women. But, when made a knight, though under the legal age, his knighthood conferred upon him the right of holding his lands, and of rendering homage for them in person; for he was then considered as *emancipated,* and admitted to the full privileges of nobility.

In many cases he was exempt from taxes; and even his servants, and all who were attached to his household, shared in some degree in the same privilege. Neither his horse nor his armour could be seized for debt, although the crown were the creditor. If he came into a court of justice as a complainant, and gained his suit, fines beyond the usual proportion were awarded him; and he could not himself be summoned to appear, without the observance of particular forms, all of which were intended to shew respect to his rank. He was empowered to act in the capacity of a magistrate; and was frequently called upon by his sovereign for his advice as a counsellor, as well as for his assistance as a warrior. When ambassadors were to be sent on any special and important mission, they were always chosen from among the clergy or the knights.

If he chanced to be taken in war, he was seldom confined in prison, and never put in fetters; his word was generally deemed sufficient security. When he was confined, a particular kind of prison was allotted him, called the prison of courtesy, (*courtoise,*) where he experienced the most delicate and respectful attention, and received every indulgence, consistent with his situation, that could soften the rigours of his captivity, and soothe the anguish he experienced on account of his ill fortune. He was at liberty to offer his services to a foreign power, when his own sovereign did not require them. When he travelled, either for the purposes of engaging in battle or tournament, himself and all his train were received and hospitably entertained at the castle of every knight which lay in his way.

The outward appearance and internal decorations of his castle bespoke his rank. The *crennels* and towers which were intended for their defence, marked also

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[*] Pinkerton, in his notes to Barbour's *Bruce,* i. 47, says, that the fleur-de-lys was only known in the time of Philip the Hardy, king of France, A. D. 1270, and was taken from the gold coins of Florence with that flower; but, according to Ruddiman, (*Introduction to Anderson's Diplomata,* 114,) Louis VII., surnamed the Younger, in 1136, first used the lily, but only a single one. Some suppose, that the tressure of Scotland was borrowed from the arms of France, in consequence and in token of the amity between the two kingdoms; but it is more probable that, in both instances, the arms were originally the head of lances, and were adopted in conformity to the custom mentioned in the text.

[†] For a striking instance of this, see *St Palaye,* i. 353. This author also cites and corrects a passage from an ancient Fabliau, which points out the armorial shield and the seal as peculiar and privileged marks of a chevalier.

[‡] St Palaye offers a derivation of the word *rogue,* which has puzzled etymologists, at least plausible and ingenious. From the circumstance of the red (rouge) colour being appropriated to men of rank and power, the word *rouge* acquired the meaning of proud and arrogant; and, by a transposition of the letters, by no means unlikely or uncommon, this author supposes the word *rogue* was formed. (i. 345.)

Privileges of the knights.

the dignities and honours of the owner. On the highest summit of them, a vane, or pennon, or a helmet was fixed, which served as a signal of courteous and welcome hospitality to all of the same order, who were journeying that way on affairs of gallantry or war. Every apartment of his castle, and the furniture with which it was embellished, and the whole domestic economy and arrangement also, were marked by the peculiar privileges and honours of knighthood.

While, however, the knight possessed these privileges and rights, and was authorised to exercise over the esquires and pages of his household supreme authority, he was deemed answerable for the faults they might commit, and every infraction of the laws of chivalry or injustice of which they might be guilty. If his armorial bearing, the symbol and proof of his rank, opened for him a passage through every fortified place, and admitted him to the palaces of sovereigns, where he was received with the utmost hospitality, and when he departed loaded with costly presents, and even supplied with money to defray the expences of his journey; he was on his part expected not only to demean himself with the utmost courtesy, but to maintain such good discipline among his esquires, pages, and other attendants, that there might be no room to complain against them. He was obliged to recompence by every means in his power, or which were required of him, every act of injustice or violence which they committed. The law fined, or punished with infamy, all who detained strayed hawks, hunting dogs, or horses; and if these were found in the possession of any of the family of a knight, not only the guilty person, but the knight himself, payed the fine, and was exposed to the infamy of the punishment. So complete and unrestricted was his authority over all who inhabited his castle, that nothing was supposed to be done without his orders, permission, or knowledge.

The institutions and laws of chivalry were so careful to mark out the knight, that the line of distinction between him and the esquire was drawn with great minuteness and particularity. This has been already partly noticed in describing the armour, the dress, and the privileges of the knight; but there are a few other particulars which we shall now point out. A shield and sword were the only weapons allowed the esquire; and he was not permitted, nor with this imperfect armour would it have been prudent, for him to engage in combat with a knight.* He was also debarred from engaging in tournaments, at least on the most solemn day, and on high occasions. While the spurs of the chevalier were gilt, those of the esquire were only silvered. The hair on the forehead of the former was carefully kept cut short, probably in order that no advantage might otherwise be taken of him in combat; the hair of the latter was not thus distinguished. It would appear, also, from two passages quoted by St Palaye, (i. 329.), from William of Tudela, that the horses of the chevaliers and the esquires were distinguished, by the former neither having their hair cut off or concealed by the armour; while the latter were unarmed, and with their hair in its natural state. It is probable that the hair of the chevaliers horses were cut off, in order that the armour might sit more closely and easily.

Besides awarding to the knight double the sum when he came into a court of law, which, under the same circumstances, would have been awarded to an esquire;—the former, when he received presents from his sovereign, or any noble, had always double in value to the latter. After a battle, when the booty was to be divided, the gold, silver, the war-horses, and the palfreys, belonged to the knights of the army; the rest were given to the esquires. In the plunder of a country, it was deemed below the dignity of the former to take any of the sheep or cattle for their share;—the ransom of a knight, also, was double that of an esquire. While the esquires and pages were obliged to perform military *watch*, this duty was dispensed with on the part of the knights. The appellations of themselves and their wives were also kept carefully distinct; while the titles of Don, Sire, Messire, Monseigneur, (for we must be indebted to the French language for the several terms), were given to the chevaliers, and those of Dame or Madame to their ladies. The titles of Monsieur, or Damoiseau, were given to the esquires, and to their wives that of Demoiselle. In short, the coat of arms, the grand symbol of chivalry, not only brought along with it many privileges, but also drew a broad and marked line of distinction betwixt all who wore it, and those who had not attained that honour.

Privileges of knight-bannerets.

Each knight was expected to bring into the field with him, his esquire, his archers, and men at arms, and four, five, or six soldiers. This was reckoned the furniture of a complete lance: but if he could bring fifty men at arms, or at least twenty-four, each with one or more serjeants, he might be admitted to the dignity of a knight *banneret*. This dignity does not appear to have been known in France before the reign of Philip Augustus; nor does it occur in English history before the reign of Edward I. The knight-banneret was distinguished by his *banner*, which was a flag of a square or oblong form, while the pennon was rounded at the end, and the guidon was nearly of a similar form. A knight-banneret could only be made by the king on the field of battle; the person for whom this honour was intended, was led between two senior knights, with trumpets sounding before them, the heralds carrying his pennon with his coat of arms;—when he reached the tent of the king, the latter took the pennon, and tearing off the top of it, converted it into a banner, and restored it to its owner. The knight banneret had some privileges which distinguished him from the simple knights: he had his peculiar cry at arms, the presents bestowed upon him were double in value to those given to the knight, and he could aspire to, and obtain, the titles of Count, Baron, Marquis, and Duke. As his standard on the field of battle was a banner of a square form, so also that which he displayed on the summit of his castle was of the same shape. Knights, unable to maintain men at arms, thought it no disgrace to fight under his banner.

In Spain, there seems to have been other distinctions; for we are informed that Count Raymond Berenpier, of Barcelona, divided the knights of his court into two classes; the highest were called *Miles vero*. On the day on which a knight of this class was made, he appointed a gentleman to hold in feu under him, and another to bear his shield and lance. The other class consisted of knights minor, who followed the art of minor chivalry without the order.

In the court of a sovereign, where there were many knights, a master was appointed over them, whose authority was very great and extensive: he carried the king's standard—judged all knights in cases of selling or pawning their horses or arms,—and settled all disputes about debts—he had power to expel, but not to adjudge to loss of limb or to death. It was his duty to see that the knights behaved to each other with friendship, courtesy, and decorum; and to maintain among them perfect order and good discipline.

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* *If, however, a knight acted with unauthorised violence, or unjustly, towards an esquire, the laws of chivalry ordered, that he should fight him on foot, armed like him only, with a sword and shield.*

Duties and virtues which the knights were called to exercise.

"The virtues and endowments that were necessary to form an accomplished knight in the flourishing times of chivalry, were such as these:—beauty, strength, and agility of body; great dexterity in dancing, wrestling, hunting, hawking, riding, tilting, and every other manly exercise; the virtues of piety, chastity, modesty, courtesy, loyalty, liberality, sobriety; and, above all, an inviolable attachment to truth, and an invincible courage." Henry's *Hist. of Engl.* book. iii. ch. 7.

Regard to truth.

The oath taken by the knight consisted of twenty-six articles; and no point, next to courage, was more insisted upon, than a regard to truth. He was even expected to relate the whole truth, when, by this means, he might expose his own misfortune or cowardice in combat. On his return from any expedition or enterprise on which he might have been engaged, he was bound to give in a full and minute account of all his adventures, honourable or dishonourable, fortunate or unfortunate, that they might be registered by the heralds, and cited to animate or to console his companions. No disgrace was reckoned so indelible as that which was received by the imputation of falsehood, or by doubting the word of a knight. Such firm reliance was placed on what he promised, that if taken prisoner, he was permitted frequently to go at liberty, on the condition that he returned and surrendered himself on the appointed day. The most solemn oath that a sovereign could take, was on his character, and on the word of a knight.

Gallantry.

But his love of truth, however great and predominating, was in some cases not equivalent to the power and influence of gallantry. A Provençal poet, who gives a chevalier instructions in the art of love, expressly tells him to prefer his mistress's favour to his regard for truth, where, by expressing that truth, he might injure her character, or weaken her passion for him. His gallantry was even to lead him to disbelieve the evidence of his own senses, if they informed him that his mistress had given him just reason to be jealous. Gallantry, indeed, as has been already observed, entered into the earliest lessons, impressions, and habits, of a chevalier. No motive or command, not even the safety of his country, the preservation of his own life, or the orders of his sovereign, could animate him to such exertions, and to such display of valour, as the hope and desire of obtaining the favour of his mistress, and the determination to render her fame and beauty known and acknowledged throughout Christendom. His highest and most valued title was that of the Servant of Love; the portrait, the device, the livery, or even the most trifling gift of his mistress, was received and cherished with the utmost fondness and reverence: the sight of these roused and preserved alive his resolution and courage in the midst of the greatest dangers and perils. He thought he established the superior and unparalleled beauty of his mistress, if he excelled his companions in feats of arms: when he challenged them to single combat, it was in the name of his mistress; when the sovereign or general led his army to the attack, "Let every one think on his mistress," was the usual and the never-failing injunction. The approbation of his commander or his comrades was but a secondary consideration—the source of inferior joy. *Ah! si ma Dame me voyoit*, was the exclamation of the knight when performing a feat of valour.

Nor was it only in the time of war that the spirit and influence of gallantry pervaded the mind and the actions of the chevalier:—in times of peace, he either devoted himself entirely to the enjoyment of her presence; or, what was more congenial to his taste, and a more certain mode of obtaining her favour, he went from court to court, from tournament to tournament, proclaiming her superior beauty, and challenging the proof of his assertion by all kinds of feats of arms.

Such was the usual character and effects of the gallantry of the age of chivalry; but many knights carried it to a most extravagant length: forming to themselves most fantastical ideas of love, and creating the image of a female perfect in beauty and in virtue, they became enamoured of the offspring of their own imagination. Others less spiritualized, but scarcely less absurd, proclaimed their love for ladies, whom they had never seen, but only read or heard of.

As the laws of chivalry forbade a knight to speak ill of the ladies, or tamely to hear them spoken ill of, it became his duty to warn them from the commission of every thing, that might lower them in his opinion: strictly decorous and respectful in his behaviour towards them, he expected that they should never forfeit their claim to such behaviour. If, however, they transgressed the laws of modesty or prudence, the knight did not fail to stigmatize their failings or their vices in the most public and severe manner; if he passed the castle of one of this character, he marked, in such a manner as could not be mistaken, the dwelling of a lady, unfit to receive a true chevalier. Even at the great feasts or the tournaments, if he perceived those of bad or suspicious character mixed with such as were honourable and virtuous, he immediately led the latter to the more honourable seat; and by this indirect reproof, or by less ambiguous means, brought the blush of shame on the countenances of the former.

Hospitality.

The hospitality of chivalry has already been incidentally noticed, when we treated on the insignia of rank that were placed on the summit of the castles of the knights; these insignia, however, were not deemed sufficient proofs, that the dwelling belonged to a chevalier, ready and desirous to entertain all his brethren, who chanced to travel that way. Every true and loyal knight was also expected to have the door of his castle constantly open: if it were found shut, his character for hospitality, and therefore for true knighthood, was stained. As soon as a knight entered the castle of another, he considered himself, and he was treated, as if he were at home; every thing that could minister to his comfort and his luxury was at his command. So much a part of the regular domestic economy was the reception and entertainment of strangers, that, let their number be ever so great, and their coming be ever so sudden and unexpected, they found every thing prepared for them.

Humanity.

Closely allied to the gallantry and hospitality of chivalry, were its humanity and courtesy: to the vanquished foe, these were exhibited with the greatest care, and with the most scrupulous and delicate attention. Nothing that could wound his feelings, or call to mind his misfortunes, was uttered before him, or brought into his presence. He was treated rather like the conqueror than the vanquished. The courtesy of knighthood even extended to inferiors: the Chevalier De la Tour, in his *Instructions to his Daughters*, quoted by St Palaye, (i. 48.), expressly recommends to them the display of an equal degree of courtesy to those of an inferior and of the highest rank; and quotes the example and the reply of a lady of high quality, who, when she was asked, why she returned the salute of a mechanic, answered, that she should have been more ashamed to have failed in courtesy towards him, than towards a person of noble birth and profession.

Gratitude.

Gratitude also was among the distinguishing virtues of a true chevalier: if in his travels he received the rights of hospitality, or the smallest favour or assistance from a person of the lowest rank, he never forgot it; he declared himself the chevalier of his benefactor, and made a solemn vow to forego the rewards of the most splendid achievements, if they were irreconcileable with his duty to succour or protect him.

Exercises of the knight.

The most noble and favourite amusement and exercise of a knight consisted in justs and tournaments; a rude and irregular species of the latter existed among the Germans in the time of Tacitus, and may indeed be traced among all savage nations that are fond of war; but the just, distinguished from the tournament, as exhibiting the combat of one against one, and the tournament itself, with its regulated pomp and solemnity of preparation and attendance, were unknown before the middle of the eleventh century.

Tournaments.

At first every knight of sufficient importance and wealth proclaimed and celebrated tournaments; but afterwards the sovereign alone exercised this privilege; and none could hold them without his licence and permission. The most frequent occasions, or at least the most splendid, when tournaments were celebrated, were at coronations, royal marriages, or splendid victories. A herald was sent to the neighbouring princes, to proclaim the approaching tournament, and to invite all whose knighthood was unstained to witness, or assist at them. The invitation was eagerly accepted; and a zealous knight did not hesitate to travel to a very great distance to be present at them.

By the laws for their regulation, which were framed by the emperor Henry the Fowler; only persons of armoria lbearings, and who could prove four descents, were admitted to them; if any came, with unfounded pretensions to these, they were excluded and punished: all criminals, also degraded knights, and especially those who had defamed the character of the ladies, were forbidden to attend them. Every knight was to appear in armour, with his armorial bearings on his shield and surcoat: his horse also was to be properly caparisoned, and adorned with the figures and *tinctures* of his arms. He was to be preceded by his esquire, bearing in his right hand his master's spear, with the pennon of his arms; and in his left, his helmet adorned with lambrekins, or the *favours* of his mistress, also of his proper tincture. When he approached the place where the tournament was to be held, he was to signify his arrival by the sound of a horn or trumpet; on this the judges of the field met him at the barrier, to whom he gave in his name, his helmet, his arms, and the proofs of his descent; these were all regularly and carefully registered; and for some days previous to the tournament, his shield was hung up on a tree in some conspicuous place.*

The practice of thus exposing the shields of those who meant to engage in the tournaments had two objects; in the first place, it was considered as a challenge to all that were willing to *just*; the page or esquire, was appointed to watch them, and whoever touched the shield of another knight, was immediately marked down in the register books, as his combatant. If the shield was touched with a blunt weapon, the combat was to be of that description; if with a sharp weapon, the combat was to be with weapons of that kind. In the second place, the public exhibition of the shields gave those who meant to attend the tournaments, and especially the ladies, an opportunity of knowing their respective owners; and if a lady discovered the shield of a knight, against whom she had any just reason of complaint, by simply touching it, she appealed to the protection and justice of the judge of the field against the culprit. If he, on enquiry, found that the complaint was well-founded, the knight was instantly punished, and forbidden to appear at the tournament; and if he did, a shower of blows with switches, laid on by the other chevaliers, and even by the ladies themselves, drove him ignominiously from the lists.

The eve of the tournaments was celebrated by justs on a smaller scale; these were called essays at arms. In these it was lawful for the esquires to engage, with arms light and easily managed, sometimes with those knights who had been recently created. If in these inferior and preparatory feats of arms, any esquire particularly distinguished himself, he was made a knight, and consequently was authorised to engage in the grand tournament.

The laws respecting the dress and arms that were to be worn at tournaments, and the mode in which the combats were to be conducted, were strictly laid down. The lance, the sword, the mace, and the dagger, were the arms allowed. The dress of the knight consisted of a long and flowing robe, which reached down to his heels. It was unlawful to strike with the point of the sword; to wound the horse; to aim a blow at any part but the face and the body; and to attack a knight when he had taken off his helmet. The judges of the field, whose business and duty it was to enforce these laws, as well as to assist the ladies in awarding the prize, were selected from the ancient knights (*veterani*), who, no longer able to engage in war or tournament, applied their wisdom and skill to regulate them.

The place destined for the tournament was fitted up with the utmost magnificence. The benches that surrounded it were filled with princes, nobles, and ladies; while the judges of the field and the heralds took their station, where they could best discharge their respective duties. When a chevalier entered the lists, who had never before engaged in a tournament, the herald, in proclaiming his approach, called upon him to remember whose son he was, and not to disgrace his ancestors. It was customary for each cavalier to enter the lists, conducted, and sometimes led by a silken chain, by their mistresses, whose favour they wore, and whose name they proclaimed as a title of honour and a presage of victory.† The first action of the knight was to wave his pennon, inscribed with religious symbols, in the air, in the form of a cross; thus displaying by the first words he uttered, and the first action he performed, his devotion and his gallantry.

As the champion of each dame was successful or otherwise, he was cheered by her applause, or roused by her approaches. If, during the combat, he lost the favour which she had given him, she presented him with another; and it not unfrequently happened, that the zeal of the lady was so outrageous and indelicate, that she deprived herself of more than the ornamental parts of her dress for this purpose. But to suffer the *favour* of his lady to be taken from him by his adversary, and not either to preserve it, or if he did lose it, to lose it by its being cut to pieces, was regarded as highly disgraceful, and as the certain cause of his mistress's estrangement.

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* Sometimes the shields were hung up in a neighbouring monastery, to which, or to the church, the arms of the horse, with which the fortunate champion had gained his triumph, were not unfrequently offered as a gift of religious gratitude.

† In the time of Edward III. ladies of the first distinction attended the tournaments on horseback, armed with daggers, and in a kind of military dress.

The ladies also bore another conspicuous and important part in the tournament. They had the right to appoint a judge of the peace, the touch of whose lance, the sign of the pleasure of the ladies, rescued those who, through inadvertence, had violated the laws of the tournament, from the attacks of his companions.

But it was at the close of the day, when the sports were finished, that the high privilege, and the most pleasing duty, of the ladies was exercised. By them the prize awarded by the judges was to be bestowed on the fortunate chevalier.* It was their duty to take off his armour; and when he received from their hands the prize, he was permitted to take, and the most noble and scrupulous were not ashamed to receive, a kiss. He was afterwards dressed in the richest robes, placed at table in the seat of honour, and treated with every mark of respect and dignity. His exploits were entered by the heralds in a register; and the minstrels celebrated his victory.

After the principal tournament was finished, it was customary to engage in another, which was denominated "the lance for the ladies." In this, if possible, the knights exceeded their former efforts in skill, enterprise, and valour.†

Single combats.

Single combats were fought, either when one knight brought an accusation against another, of having broken the laws of God, of the land, or of chivalry; or between knights of different nations in time of war; or to revenge private quarrels; or to prove the superior beauty and qualifications of a mistress.

Judicial combats.

In judicial combats, the accused person was obliged to appear before the judge of the field on an appointed day; and if he denied the accusation, the challenge was thrown down, and accepted by each party. The judge first took up the challenge of the defendant, and afterwards that of the accuser. They were both immediately after that confined till the day of combat, or committed to the care of their respective friends, who became bound for their appearance, dead or alive, till the appointed day. If then either party did not make his appearance, his surety was ignominiously, and sometimes capitally punished. If he had died in the mean time, the surety brought the dead body into the lists; if it happen to be the accuser, the defendant has no other mode of proving his innocence, but by throwing the body out of the lists. Lindsay mentions a curious case, where the dead body was so heavy, that the other party could not lift and throw it without the barriers. The surety of the dead person therefore contended, that as he had neither *confessed,* nor been cast out of the lists, and the *peremptory* day was past, his friend had won his action.‡

On the day of combat, the parties took a solemn oath, that they had no weapons, but such as were allowed, and had been assigned them by the marshall; that they carried about them no spell and enchantment; and that they trusted in nothing but God, their own prowess, and the justice of their cause. Their hair was cut short round the forehead and about the ears; and their bodies had been generally previously anointed with oil. Before the combat began, each party repeated his challenge, and his defence or denial. Immediately afterwards they entered the lists, which were protected and surrounded by four or more knights. An hour was then spent in devotion; and when this was finished, the cry of the marshall, "Come forth," was the signal for the rencontre. If, on the appearance of the stars, the combat was not finished, the accused was deemed victorious, and consequently his innocence was established; but it was established less equivocally, and more honourably, by the death of his antagonist. The conqueror was not obliged to show mercy, unless the vanquished begged it;—the dagger was used to dispatch the fallen foe. When either of the combatants was dying, a priest attended to confess him; and it was deemed honourable, and a proof of high courage, to be confessed and die without taking off the helmet. The accused, if vanquished, sometimes was not put to death on the spot; but led forth, hanged, and beheaded;—even this was done, in cases of murder and treason, to the dead body of the culprit, who had been slain in combat. It sometimes happened, that one person engaged several;—in this case, after he had defeated one of his antagonists, he was led out of the lists by the judges, who disarmed him, and gave him three sops, probably of bread steeped in wine, before he renewed the combat.

Simple affairs of arms.

In simple affairs of arms or of gallantry, the challenge was given by touching the shield, as in the case of tournaments. There was generally a shield of peace and another of war hung up; and the combat was "to outrance," or otherwise, as one or other of these was touched. Sometimes the shield, adorned with an *emprise*, a ribbon or chain, was hung up: if the emprise was snatched away, the combat was for outrance; if only touched, for simple feats of arms. During sieges, single combat was often held on the drawbridge or barriers of the town, between knights of the opposing parties. "The former, as the more desperate place of battle, was frequently chosen by knights, to break a lance for honour and their ladies love," (Scott's *Minstrelsy*, iii. 36.); and as this mode was very dangerous, the mode of attack and defence was early and regularly taught all knights. In simple affairs of arms or gallantry, the vanquished was generally disarmed, and led forth out of the lists ignominiously. In affairs of gallantry, the vanquished was obliged to confess the superior charms of his antagonist's mistress. In combats, as well as in tournaments, if either party was carried by his horse without the lists, he was reckoned to have lost the guerdon of his valour.

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* The decision turned upon several circumstances: he who had broke the greatest number of lances; or who had exhibited the greatest skill in attack and defence with the lance and the sword; or who had continued on horseback the longest; or who, in the thickest combat, had been able to keep his helmet on the longest, without being obliged to take it off, for the purpose of breathing; was, according to circumstances, or the opinion of the judges, declared victor. The prize was sometimes very valuable; sometimes only a wreath placed on his head by the ladies, and called in the language of romance, "The chaplet of honour."

† The combat of the lance on horseback was deemed the most honourable; that with the sword the most dangerous; the superior honour of the combat with the lance was marked by the following circumstance: When a knight came to a tournament for the first time, he had to give a certain sum to the herald; if his first combat was with the lance, what he paid freed his future combat with the sword; but what he paid, if his first combat was with the latter, did not free his future combats with the lance; hence, the maxim in chivalry, the lance frees the sword, but not the sword the lance.

‡ Lindsay's MS. *Heraldry*, quoted by Dr Leyden, *Complaynt of Scotland,* Introduction, 86.

Vows of the knights.

Beside the solemn oath of chivalry, which a knight took when he was admitted into the order, and which he renewed very frequently, he was accustomed to make vows of enterprise. The occasions on which these were taken were numerous. As a young knight was said not to have won his spurs till he proved his valour and his gallantry, he was obliged to wear on his arm some mark of his inexperience and thraldom, which he solemnly vowed not to remove till he had achieved some feat of chivalry. At solemn feasts and tournaments also, in order to recommend themselves to the ladies, the knights used to take vows of enterprise; and, as a mark of their engagement, chains of gold were fastened to their arms by their favourite mistresses, who at the same time granted them a reluctant kiss.

The most solemn vow that a knight could take, was by the peacock and the ladies. The latter needs no explanation; the former took its origin from the circumstance of the peacock forming the most splendid and magnificent part in grand entertainments, given by princes, on occasions of chivalry. After being roasted, it was again dressed in its plumage,—a sponge, dipt in lighted spirits of wine, was placed in its bill; and it was thus brought into the hall on a gold or silver dish, by the most distinguished and noble ladies. In this state it was presented to each knight, who vowed by it, and the ladies who were present. The bird was then placed on the table, cut up with great solemnity and parade, and distributed among the guests.

These vows were frequently of the most extravagant nature:—"To be first in advancing, and last in retreating; to strike upon the gate of a certain fortress of the enemy; to fight blindfold, or with one arm tied up; to carry off a banner, or to defend one;" were among the more usual and rational subjects of their vows. Froissart relates, that when Edward III. began his war against France, many of the knights of England bound up one of their eyes with a silk ribbond, and swore before the peacock and the ladies, that they would not make use of the other eye, till they had accomplished certain deeds of arms: and Bertrand du Guesclin swore, at the siege of Montcontour, that he would neither eat meat, nor undress himself, till he had taken it. The besieged, on the other hand, often swore, that they would devour one another, rather than yield up the place. John of Bourbon, in 1414, in order to acquire the favour of his mistress, vowed; that he and sixteen other knights and esquires would wear, every Sunday, for the space of two years, a chain on their left leg, of gold for the knights, and of silver for the esquires, till they had met with and engaged an equal number of their respective ranks.

As soon as a knight had made his vow, and fastened on his *emprise*, he prepared himself for the accomplishment, by prayer and fasting. He entered the church, where he confessed himself, and in which, as has been already noticed, he offered up his arms, if he proved successful. When the *emprise*, the mark of his engagement, was once fixed, either on his armour or his person, he could not free himself from it, till he had fulfilled the conditions of his vow; or till he had met another knight, on whom, after having defeated him in single combat, he fastened it.

Amusements of the knights.

The knight filled up his leisure hours with different kinds of amusements. Hawking, or the mystery of the rivers, so called, because wild fowl were principally taken; and hunting, or the mystery of the woods, were his favourite sports. Of course, his dogs and his falcons were the objects of his particular care and attention. When he rode out, his esquires carried his hawks, while the falcon, his special favourite, was perched on his own finger. No higher praise could be given to a knight, than that he was equally celebrated for, and equally able to converse on, subjects relating to hawking, hunting, arms, and love.

In his castle he amused himself with hearing read the exploits and adventures of the most renowned knights; or the songs of the minstrels; or the sports or tricks of the jonglers; or with games at chess, dice, and backgammon. The former, he was carefully taught from his infancy; its resemblance to war, that grand object of his life, made it his favourite game. He generally played at it with the ladies; but it was not permitted to play for money; or, at least, the sum he might lose in one day was strictly limited. Dice were regarded as not so honourable a game. An amusement is also mentioned in ancient writers on chivalry, the nature of which is not clearly described; it seems to have consisted in setting up a wooden castle, so loosely made, that the parts of it would easily fall to pieces, and in throwing at it with wands. A game at bowls, played in alleys, seems likewise to have filled up the leisure hours of the knights.

Although the castles, and entertainments of the knights, have been incidentally touched upon, a few particulars may be added. Towards the court yard of the castle, there were generally open galleries, from which the ladies might view the procession, and the sports, and distribute the prizes at tournaments. St Palaye supposes, that the barriers, which enclosed the houses that were occupied by the princes of the blood and the grand officers of the crown, in Paris, before the revolution, took their origin from the circumstance, that they alone could celebrate justs and tournaments, and were, in fact, the lists erected and used for that purpose. In the great hall of the castle, there were two longitudinal seats, in the middle of which, and generally fronting the southern door, was a bench more raised than the rest. This was the seat of honour. At solemn feasts, moveable tapestry was placed behind it, and a canopy hung over it. When it was intended to receive a knight, who had distinguished himself in battle, or in feats of arms, with more than usual dignity, he was placed on the high table, to which he was permitted to ride through the hall on his war horse, adorned with his armorial bearings, and all its trappings. In the language of chivalry, he was, when thus placed, said to begin the board.

At their entertainments, but especially in the evening, different spiceries, sweet-meats, and wines, were served up by the esquires; *clairet*, or wine clarified with spices; *pimeate*, which consisted of wine, spices, and honey; and burnt wine, were most commonly used. Just before they retired to bed, *vin du coucher*, consisting of wine and the other materials just mentioned, was given to each guest. At the close of the entertainment, either the esquires brought in water for the guests to wash themselves, or the guests went, for that purpose, to another apartment; in the latter case, the lady of the castle led out first the guest which she wished particularly to distinguish.

Ceremony of degrading knights.

As the dignity, the duty, and the privileges of chivalry were so great and numerous, and as the ceremonies, by which an esquire was admitted into the order, were solemn and imposing, so also was the ceremony by which an unworthy member was declared to the world stripped of his dignity and his privileges, and deficient in his duty. This degradation took place, when a knight was guilty of treason, murder, or cowardice; sometimes, even the circumstance of his being defeated in single combat, as in the case of Henry de Essex, in 1163, who was vanquished in a duel with Robert de Montfort, was sufficient to degrade him.

The knight who was adjudged to this punishment, was led upon a scaffold, his spurs were hewn off by a servant, his sword broken over his head, his armorial bearings torn to pieces, and his shield tied, with the upper part downwards, to the tail of a horse, was dragged along the ground. This position of the shield was deemed a symbol of the death of a chevalier, and a chevalier who had dishonoured himself was looked upon as dead. To follow up this idea, the priests, after having recited the funeral ceremony, repeated, over his head, the 107th Psalm, which contains imprecations on all traitors. Thrice the herald at arms demanded the name of the criminal; and as often as the pursuivant at arms named him, the former replied, that this could not be the name of the knight they said, since in him he beheld only a traitor, at the same time pronouncing him no longer a knight but a knave. On this the herald threw over him a bason full of warm water, to efface the sacred character of chivalry, which the *accolade* had bestowed. He was afterwards taken from the scaffold, with a cord fastened under his arms, laid on a hurdle, covered over with a pall, and placed thus in a church, where the funeral service was again said over him.

For lesser faults, a knight was degraded by being obliged to ride on a work-horse; or by being deprived of part of his armorial bearings. There was also a kind of punishment inflicted on him, when he misbehaved, ridiculous, and tantalizing, rather than severe. This consisted in snatching away the cloth from the table where he was eating, if he presumed to seat himself near unsullied knights; and if thus disturbed, he went to the table of the esquires, he was there treated in the same manner. Sometimes, when a knight had been ignominiously conquered in battle or in feats of arms, he voluntarily condemned himself to abstain from chivalry for a year and a day.

Employment of the aged knights.

As a chevalier advanced in years, he gradually withdrew himself from the employments of knighthood. He first abstained from engaging in tournaments; and when he had reached his sixtieth year, he was authorised to decline any challenge, and exempted from his fief; he was, however, expected to give his horse and his arms to the lord under whose banner he had fought, and under whom he had held his lands. These were in exchange for his personal service; if he held no fief, he generally, at the close of his military life, laid his arms at the feet of his mistress, or deposited them in a church. It not unfrequently happened, that the religious feeling, which had been early instilled into his mind, and which, in the prime of his life, had been overshadowed by his love of arms and his gallantry, broke out with redoubled force in his old age; in this case, he exchanged the duties of a chevalier for those of a monk, or taking up the cross, went on a pilgrimage to the Holy Land. A Provençal poet, in his Lay of a Bachelor at Arms, expressly states, that, in order to obtain and deserve the appellation of a perfect chevalier (*Preudhomme*), it is necessary that the last years of a knight should be spent in this manner.

Ceremonies at the funerals of the knights.

If a chevalier was killed in the field of battle, his funeral rites were celebrated with more regard to his glory than to pomp and magnificence. If he was killed storming a castle or a fortress, his body was buried in the breach. When he died a natural death, the ceremonies of his funeral were varied according to circumstances; if he had performed, or even only planned and begun a crusade, he was carried to the grave armed, with his legs crossed; and the sculpture on the tomb was in the same attitude.* The swords of the most renowned and valiant knights, which had been the instruments of their victories, were held in the highest estimation; they were sought after with avidity; and when obtained, they were hung up in the arsenal or great hall of the castle, as honourable monuments, and as proper incitements to rival the courage of those, by whom they had been so often wielded with success, in advancing the glory, and performing the duties of chivalry.

Knight errantry.

A discussion on chivalry, which should omit the subject of knight errantry, would be deemed incomplete in the most curious, if not the most interesting point; and yet it is extremely difficult to obtain authentic evidence respecting the knight errants. In the old romances, they occupy the most distinguished place; but in the old historians and chronicles, only a few faint traces of them are to be found.

The spirit and the practice of going in quest of adventures, arose partly from the very nature of the institution of chivalry, and partly from the custom of knights travelling wherever tournaments were to be celebrated: this spirit and practice were undoubtedly increased by the Crusades. In their expeditions to the Holy Land, knights would necessarily meet with many opportunities of displaying their valour and their gallantry, and of performing that part of their vow, which bound them to succour the widow, the orphan, and the helpless. So desirous were the young knights of seeking and obtaining opportunities of signalizing themselves, and of acting in the capacity of the avengers of the injured, and the defenders of the weak, that they frequently bound themselves to spend the first years of their knighthood in visiting foreign lands, in order to make themselves "perfect knights." For this purpose, they studied the customs of different countries, and made themselves acquainted with the rites of their tournaments, and the ceremonials of their courts. The character of their sovereigns, and especially of their most celebrated ladies, was also a part of their preparatory knowledge. Thus fitted for the object they had in view, they set out, attended by their squires; and they chose that road, which they thought would present them with most opportunities of meeting and overcoming danger, in the punishment of crimes, in the repressing of violence, in the protection of insulted, or in the liberation of confined damsels.

A real knight-errant, more frequently met with in romances than in history, clothed in green,—for that was his favourite colour, as expressive of the freshness of his age, and the vigour of his courage, †—and with nothing but what was absolutely necessary for attack or defence, chose his path through forests or unfrequented tracks; for his food, he depended entirely on the animals he killed; these he cooked in the most simple and rude manner; a stone served him for a table, and it also served him to press the blood from the newly killed animal. Thus prepared, he made his scanty and savage meal, with some salt and spices, the only things he carried with him, beside his arms. For a year and a day he wandered in this manner, in quest of adventures; sometimes reaching and punishing those crimes which were beyond the knowledge, or the reach of the law; and not unfrequently committing injustice and violence in the very act of relieving the oppressed, or punishing the criminal.

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* Olivier de la Marche, however, as quoted by St Palaye, says, that unless a knight was slain in battle, his banner, his standard, and his pennon, were not carried with him to the grave; but only one or two of these.

† When a knight errant had reason to despair [illegible] of his [illegible], the colour of faded leaves.

Perhaps the most striking instance of knight-errantry that is well authenticated, is given by Brantome. This author relates, that Galeas of Mantua, in gratitude to Queen Joan of Naples, for having danced with him, made a vow that he would become a knight-errant till he had conquered and brought into her presence two knights. At the end of a year, which he spent in combats, in England, Spain, Germany, Hungary, and other parts, he accomplished his vow.

The fraternities or brotherhoods, which sprung out of chivalry, or at least were rendered more frequent and better organised by it, rest on surer authority. It has been already observed, that a similar institution existed among the Scandinavians; and it is remarkable, that one of the most common modes of entering into the fraternities of chivalry, was by mingling the blood of the parties,—a practice usual among the Scythians. Sometimes religious ceremonies were employed, and not unfrequently an exchange of arms was the proof and bond of fraternity. So predominant and indispensable was the mutual obligation thus formed, that a knight was justified in not attending to the call of a suffering and oppressed female, if, at the same time, his brother in arms required his presence. His sovereign, however, had a superior claim upon him; and the obligation was dissolved, when war was declared between the countries to which they respectively belonged.

The union was deemed so intimate, that all the members of the fraternity wore the same dress, and carried the same arms; and no member could admit, or acknowledge as his friend, any who was not also the friend of the fraternity; as they were mutually bound to assist one another, they could not undertake any enterprise except in concert. The principal object of the fraternities was to free their country from robbers; to go on expeditions against the Infidels; and to accomplish with more effect and glory all the purposes and duties of chivalry.

These fraternities were entered into, sometimes for life; but more frequently only during a campaign, a battle, a siege, or a war; at the termination of the engagement, each party rendered up an exact and faithful account of what he had gained in booty or in presents, or of what he had expended or lost.

Education, &c. of the ladies in the time of chivalry.

The education, the manners, and the employments of the ladies, in the days of chivalry, have, in the course of this article, been noticed with nearly as much fullness and minuteness, as the subject requires or admits of. The scattered observations on these points may be here briefly brought together, and a few additional circumstances introduced. The manners of the ladies were necessarily polite and courteous; for such they taught, and expected those of the chevaliers to be. Their principal ambition was to deserve and obtain the love of a valiant knight; but their idea of love led them to prefer his death to his dishonour. "According to the laws of gallantry, I should have loved him better dead than alive!" was the exclamation of a damsel, on hearing that her knight had escaped alive, but with the loss of his honour, while the knights of her companions had died the death of chivalry. To rouse him to enterprise, to reward him with her approbation, with her smiles, perhaps with a kiss, if victorious;—to shame him by her reproaches, if vanquished, were the great objects of her life. It was the business of the ladies to adorn the armour of the knights with *favours;* to take it off when the tournaments were finished; to bestow on them the prize; and to attend to them when wounded. They likewise joined them in playing at chess, backgammon, and dice. It is probable, that they sometimes took the diversion of hawking; at least, they scarcely ever appeared in public without a falcon on their finger, as a mark of their dignity. The bath was much used by them, not only for the purpose of preserving or increasing their beauty, but also for the sake of enjoying free and uninterrupted conversation. Their magnificence and luxury, like those of the knights, were great, and was discovered in their dress, and in all their domestic arrangements. One instance may be given: they had always burning in their chambers, while they were in bed, the most delicate and costly perfumes.

Effects of chivalry.

The effects which chivalry produced on the age in which it existed, the circumstances which led to its decline and extinction, and the traces of its character and influence that still appear, may be briefly and rapidly told.

The qualifications and duties that chivalry imposed and required, which have been so fully detailed and explained, though they were sometimes evaded or transgressed, sometimes altogether wanting in its knights, and too often overpowered by the ignorance and violence of the age, or mixed up with its vices, yet undoubtedly tended, in a very considerable degree, to give efficacy to laws in the time of their weakness, and to supply their place in many important cases, which they could not touch. This institution also infused humanity into war, at a time when the disposition of the age made it the almost constant business of life, and the ruling passion of all conditions of men; it introduced courtesy of manners, when men, from ignorance, and want of mutual assistance and intercourse, were naturally rude and uncultivated; it exacted and produced a scrupulous adherence to truth, at a time when the temptations to falsehood and breach of engagements were numerous, and the personal and social evils resulting from these vices, were imperfectly understood and feebly felt. It added an additional impulse and motive to that respectful and delicate attention to the female sex, (which distinguished the Gothic ancestors of Europe,) at a period when this attention, and the protection and support which accompanied it, were particularly necessary to them.

Decline and extinction of chivalry.

In sketching out the causes of the decline and extinction of chivalry, the period when they took place will be sufficiently marked. As it rose to splendour, and was embodied into form and regularity by the feudal system, so it fell along with it. The causes which broke up this system; the change of manners, habits, and pursuits among mankind in general, and of the principles and conduct of governments, and especially of their military and financial institutions, and of their mode of carrying on war, were fatal alike to the feudal system and to chivalry. The same era which witnessed the discovery of gunpowder and artillery, and the invention of printing, and in which there sprung up the seeds of commerce, witnessed and produced the decline of chivalry. All these circumstances operated on the habits and the manners of the age, and, in conjunction with the destruction of the feudal system, put a period to the existence of chivalry. As it arose principally from a peculiar state of society, the evils of which it was calculated to remove or alleviate, so it fell, when that state and those evils had given way to the general diffusion of knowledge and of wealth.

But the spirit of the institution may still be traced. "The humanity which accompanies all the operations of war, the refinements of gallantry, and the point of honour, the three chief circumstances which distinguish modern from ancient manners," at once demonstrate its extensive and permanent influence, and the beneficial nature and effects of its principles.

Reference to authors.

The authors that treat on the subject of chivalry may be divided into two classes:—1st, Those who have endeavoured to trace its origin and causes. Of these, some indulge principally in antiquarian research, and others in general reasoning; of the latter, the most celebrated are Hurd, in his Letters on Chivalry and Romance, which are appended to his *Moral and Political Dialogues*, in 3 vols 12mo; Gilbert Stuart, in his *View of Society in Europe*; Robertson, in his View of the State of Europe, prefixed to his *History of Charles V.*; and Herder, in his *Outlines of the Philosophy of the History of Man*. This author also in some degree unites antiquarian research with general reasoning. *Gibbon*, in his 58th chap. and 11th volume, has given a rapid, but masterly view of the origin and the principal features of chivalry. The antiquarian researches on this subject are to be found rather detached and scattered in different works, than in complete and regular treatises. The notes of Warburton and Tyrwhitt towards the conclusion of *Love's Labour Lost*; Warton, in his first dissertation prefixed to his *History of English Poetry*, and occasionally and incidentally in the *History* itself; Mallet in his Introduction to the *History of Denmark* translated by Percy; Percy, in his 3d volume of the *Reliques of Ancient Poetry*; Pinkerton, in his *Dissertation on the Scythians and Goths*; Dr Leyden, in the Introduction to the *Complaynt of Scotland*; and an anonymous writer in the *Monthly Magazine* for February 1800; have been already referred to, and supply curious and valuable information on the antiquarian branch of the subject. Notices on the same branch are scattered in Selden's *Titles of Honour*; in *Essais sur la Noblesse de France*, by Boullainvilliers; in *Histoire de l'Ancien Gouvernment de France*, by the same author; in *Les Recherches de la France*, by Pasquin; and in Ashmole on the *Order of the Garter*.

2d, The last named authors may also be consulted respecting the institutions of chivalry. But the most copious, authentic, and interesting author on this branch of the subject, is Mons. de St. Palaye, in his *Memoires sur l'Ancienne Chevalerie*,* either in his work, or in the author whom he cites or refers to, almost every particular respecting the institutions of chivalry, especially French chivalry, may be found. This work has been translated into German by Klueber, who has added many particulars respecting German chivalry. Some additional information on the laws and manners of chivalry may be gleaned from Lyttelton's *History of Henry II.* vol. iii.; Henry's *History of Great Britain*, vol. vi. (8vo edition); and especially from the ancient Ballads and Romances that have been edited by Percy, Ritson, Pinkerton, Ellis, and Scott, and in the notes by which they are respectively illustrated. It is hardly necessary to add, that Chaucer and Spenser, particularly the former, throw considerable light on chivalry; and that the notes of Tyrwhit to this poet, and the observations of Warton and Tod on Spenser, may be read with advantage.

(W. S.)

CHLOANTHES, a genus of plants of the class Didynamia, and order Angiospermia. See BOTANY, p. 257; and Brown's *Prodromus Plant. Nov. Holl*, &c. p. 514. (*w*)

CHLORA, a genus of plants of the class Octandria, and order Monogynia. See BOTANY, p. 201.

CHLORANTHUS, a genus of plants of the class Tetrandria, and order Monogynia. See BOTANY, p. 126.

CHLORIS, a genus of plants of the class Polygamia, and order Monœcia. See BOTANY, p. 342.

CHLOROMYRON, a genus of plants of the class Polyandria, and order Monogynia. See BOTANY, p. 241.

CHLOROPHYTUM, a genus of plants of the class Hexandria, and order Monogynia. See BOTANY, p. 195, and Brown's *Prodromus*, &c. p. 276.

CHOCOLATE. The *Theobroma Cacao* is a native of South America, and produces a nut, the kernel of which is the basis of chocolate, which has from time immemorial been an important article of food among the Indians, and which has become, since the discovery of America, an indispensable article of luxury to European Spaniards. The tree belongs to the genus *Theobroma*, of which there are three species, the *Theobroma Cacao*, already mentioned, the *Theobroma Gujanensis*, and the *Theobroma bicolor*. This genus belongs to the class Polyadelphia, and to the order Pentagynia. For the essential character, see the article BOTANY, p. 287. This tree is not now confined to the Spanish colonies; but is cultivated considerably in some of the British settlements. Prepared chocolate is very highly prized, although, from political considerations, it is altogether excluded from the British market by the legislature. The cacao-nut, however, is less exorbitantly taxed, and may be introduced; and that from the Caraccas is most valuable. The quality of the Spanish cacao varies, as well as that of the colonies of other nations in the western hemisphere. That of Orituco is superior to all the other kinds. Such is its compactness and density, that an equal bulk will weigh twenty per cent. more than that of any other cacao. The next in point of quality is the cacao of the coast, and last of all that of the interior.

Cultivation.

The cacao plantations of the Caraccas, are chiefly confined to the northern portion of that chain of mountains which skirts the coast of the province.

Much nicety and judgment are necessary in selecting a soil and situation appropriate to this kind of produce. The Spaniards, in judging of the fertility of the ground, do not trust to the results of analysis, to the colour, or to any character, except those derived from the luxuriance of the trees growing on it. The exposure should not be to the north; and the situation should be on the banks of a river, from which the benefits of irrigation may be derived in dry seasons, and against any sudden overflow, of which there are sufficient safeguards.

A piece of land having been chosen, it is cleared of all the natural vegetation. This is effected in several ways;

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* This work has been translated into English by Mrs Dobson.

but the most common is to cut down the wood, allow it to dry very thoroughly, and then to burn it. The plantation is then drained; and small trenches are cut, so as to carry off all superabundant moisture. The cacao plants are then arranged either in straight lines, so as to make a cross, formed by the junction of the apices of two triangles, or in that of a square. The distance of the trees from each other should be fifteen or sixteen French feet in good soil, and about twelve or thirteen in that which is inferior.

It is peculiarly necessary to defend this tree from the scorching rays of the sun, and at the same time sufficient warmth should be afforded to secure the vegetation. This is done by planting it with the plantain tree and the erytrina, which answer all the objects desired. The whole plantation is guarded by the cassaoa plants. The cacao plants which are transplanted, should not exceed three feet in height; when they are larger they are less manageable, and more apt to die. The nurseries of the cacao require very fine land, well dressed, and free from wet. They should be sheltered from the sun. Small heaps of earth are collected, into each of which two seeds of the cacao are set. For the first twenty-four hours the rows are covered with plantain leaves. The ground is watered, if necessary, but no water is allowed to remain on it. The period best suited to this operation, is in the month of November.

The season, however, for planting the cacao nut, depends upon the situation of the plantation; where there is no abundance of water, the dry season; when there is a scarcity, the rainy season. The former is the best, when attainable, as the quantity of moisture can be easily regulated. During the period of transplantation, the plants must be kept perfectly dry. When the two seeds in each heap have germinated, the weakest plant is destroyed to give greater vigour to the remaining one. The plantain trees should be carefully cut down when they become old, lest in their fall they should injure the cacao trees.

Great care is bestowed in cutting off the superfluous branches of the young trees, so as to give them the benefit of the whole of the circulating fluids. All young shoots from the root are destroyed.

After the cacao walk is completed, great attention is necessary to keep it in order. The trees must be freed from the cryptogamous plants that grow on them, the earth worms must be destroyed, the walks must be cleared from all weeds, the trenches for drainage must be constantly deepened, so that after the roots have sunk five or six feet into the soil, the moisture may be equally diffused, for when there is too much the root decays. This precaution not only ensures the health of the trees, but also a larger crop. The branches should not be too often lopped, as when this is done the tree frequently dies.

The nut withers upon the tree from several causes, which frequently cannot be obviated. But we cannot enter so minutely into this subject as we wish, from the nature of our work.

There are two principal crops of cacao in the year, the first about St John's day, and the second about the end of December. Frequently the crop fails; and generally a considerable quantity of the nut is found to be decayed. Great benefit is said to be derived from gathering the fruit when the moon is waning, yet some intelligent people ridicule this opinion, as a mere prejudice, and impracticable to any extent, without a certain loss by the decay of a large portion of the fruit.

The people employed in gathering, carrying, and separating the external coat of the cacao nut, are selected with care; the gatherers are composed of those whose sight is good, so that no unripe fruit shall be pulled; the strongest and most active are the carriers; and the old infirm slaves open the shell and take off the husk. These two last operations are performed by two classes of the feeble old people.

Good cacao should be separated from that which is either indifferent or bad. In general there are four kinds of cacao in each crop: the ripe, the green, the perfectly formed, that which is worm eaten, and the rotten. Whenever the first of these (the ripe) begins to ferment, it should be separated. The unripe nuts should be covered with the leaves of the plantain for three days, in order that they may ripen thoroughly. All the nuts are then stored; and it is indispensably necessary, that no leaves or pieces of the shell, or any other refuse, should be left in the store-house. And this is to be attended whenever the store-house is cleaned out.

But previous to this storing of the cacao, it must be very completely dried in the sun, as moisture is highly prejudicial to its being kept good. The best criteria of its being dry, are its not crackling when broken, and not heating when collected into heaps. When imperfectly dried, the nuts become mouldy; and on the other hand too much drying renders it liable to decay.

When the crop is considerable, a hundred quintals of cacao may be put out to dry in the sun at once, unless the plantation has a sufficient number of hands to convey a larger quantity. Should the season be rainy, the cacao ought to be dried in large, well ventilated, and covered galleries, with which every plantation should be furnished. Mr Depons suggests that stoves might be advantageously introduced, although they are as yet unknown in the colonies.

The storehouses, in which the cacao is kept, ought to be floored and wainscoated, and a small chaffing dish, covered with a funnel, the pipe of which enters the heap of the produce, and diffuses the smoke throughout it. Some put bottles of vinegar, slightly covered, in the houses, as a preservative against worms.

The nuts which are slightly tainted, may be preserved from entire decay, by a slight sprinkling of brine, which might be used as a preservative. Thus both salt and smoke are found useful; yet, singular to say, they are only resorted to after the destruction has been partial.

One slave is equal to the management of a thousand cacoa trees, each of which yields one lb. in middling soil, and one and a half in the best. The mean in the Caraccas, according to Depons, is about 20 ounces per tree. So that the produce of 1000 trees will be 1250 lbs. of cacao, which, even at a moderate rate, is a very handsome return for the work of each labourer. The expences of cultivation and necessary machinery is very trifling; the various accidents to which this kind of produce is liable, are the only drawbacks that lessen the number of its cultivators.

The cacao tree is not in full vigour until the seventh or eighth year, (according to the situation of the plantation,) though, in some remarkable spots, it attains perfection in four years. It retains its vigour for 50 years.

The cacao tree is obnoxious to several diseases, the most common of which are induced by the injuries inflicted on it by several kinds of worms, of which we shall give Depons' account, and by parasitic plants. The first of these caterpillars is small, of an ash grey colour, which, on being squeezed, emits a noise like the hissing of cold water on red-hot iron. It has two small horns on its head. It is so tenacious of life, that its head retains some activity long after it has been separated from its body. It is deposited in small holes in the bark." The only mode of destroying it is by hand.

"At the beginning of the rainy season, another very destructive insect appears, and destroys the leaves of the tree. It is four inches long, of the thickness of one's finger, and of various colours. It is called *Goosino* by some, and *Angaripola* by others. These destructive creatures are sometimes so numerous, as to afford continued employment to the whole establishment in killing them. They are deposited by butterflies, which have escaped the vigilance of the planter. When they appear and fly about, fires, sufficiently large to attract their notice, should be made on different parts, and they always fly into the flames."

There is a third variety of caterpillars called *Rosquilla*, which infest certain districts. It thrives in the dry season.

There are also others called *Acerredores*, larger and blacker than the others, that destroy the bark. They gnaw the wood.

The caterpillars called *Vachaeos*, are also very mischievous in devouring the leaves and the flowers. The earth, in which they have their nests, must be taken away.

Parasitic plants that attach themselves to the cacao tree, must be removed by hand, or the tree will perish.

The cacao tree is subject to blotches on the bark, which must be extirpated by the knife.

Stags, monkeys, and other animals, destroy the tree and its produce. The precautions to guard against their incursions must be suggested by local circumstances.

Chocolate is a well known paste, the basis of which is the cacao, and occasionally other ingredients are added to heighten its flavour. The rudest mode of preparing the chocolate, is by roasting the nut in an earthen pot, then grinding it between two stones, and last of all by moulding it into any form by the hand. The more improved method is the following one: After the cacao has been properly roasted and freed from every impurity, it is pounded in a mortar into a coarse powder, which is sufficiently ground on a stone to the greatest degree of fineness, and heated, when it is put into cylindrical or flat moulds, in which it congeals and is fit for use. The Spaniards mix spices of different kinds, besides large quantities of drugs, which are offensive to some palates. In England and France, Vanilla sugar, and occasionally cinnamon, are the ingredients that are added. The chocolate manufactured in this country pays an inland tax of about 1s. 6d. per pound; and must be wrapped up in stamped papers. After a notice of three days, private families may make chocolate for their own use, provided, that not less than half a hundred weight of cacao nuts be used at once.

Although foreigners prefer the Spanish chocolate, that which is prepared in this country is better triturated, and does not yield the quantity of oil which renders the other so disagreeable. When well prepared and properly boiled, (which is an operation of more delicacy than is commonly imagined) it is an excellent, nutrient food for people whose stomachs are weak.

Chocolate has had many virtues ascribed to it, although modern physicians do not recognise them. Its chief virtue appears to consist in its being very agreeable to most palates, easily digested, and very nutritive.

Chocolate, fresh ground, and cooled in tin vessels, becomes highly electrical, as was observed by Mr Henley. This property it retains until it has been much handled. It also loses it on being dried and powdered, but regains it when the chocolate is well mixed with some olive oil in an iron pot. These facts have given rise to some conjectures, which we need not repeat. See *Voyage a la Terre-ferme par* Depons, &c.; Cullen's *Materia Medica*; *Willdenow*, &c. (C. M.)

CHOMELIA, a genus of plants of the class Tetrandria, and order Monogynia. See BOTANY, p. 120.

CHONDRILLA, a genus of plants of the class Syngenesia, and order Polygamia Æqualis. See BOTANY, p. 290.

CHORAL FUND. Among the numerous benevolent institutions which receive the patronage and support of the British public, is an institution called the Choral Fund, established in London, which had its origin in the active zeal of Messrs John Farey, Joseph Doane, Robert Willoughby, Leonard Willshire, Thomas Elliot, and other members of private societies, for practising choral music once a week. These gentlemen having, in 1791, projected a plan of uniting these societies, and establishing a common fund for the relief of choral vocal performers in sickness, and for their widows and orphans, the plan was no sooner submitted to the late Dr Samuel Arnold, than he patronised it in the most liberal manner, and assisted in conducting, a public concert annually, for the benefit of this fund, which met with the most flattering support from the public. On the death of Dr Arnold, Messrs Greatorex, Harrison, and Bartleman, handsomely came forward to lend their professional aid in conducting the concerts, by which, and the high noble patronage which the institution has progressively received, its credit and funds have been rapidly increasing, and it has already done extensive good. The Prince Regent, and the Royal Dukes of Clarence, Sussex, and Cambridge being at present patrons, and the Duke of Manchester president. Among a most respectable list of vice-presidents, the name of the lord mayor of London, for the time being, has always appeared for several years back, with many aldermen, some eminent musicians, &c. (ς)

CHORD, in Music, is sometimes used synonymously with *Consonance*, to denote the combined effect of two musical sounds heard together, but more commonly practical musicians and theorists intend *three* sounds, at least, to be heard together, to constitute a chord; and these they distinguish by various names, as accidental, borrowed, common, complete, connecting, direct, equivocal, essential, uncommon, &c. or, the added sixth, diminished seventh, extreme sharp sixth, fifth and sixth, fourth and sixth, redundant sixth, second and fourth, second and third, sixth, sixth and ninth, sixth and seventh, third and fourth, &c. It is almost general with writers on the theory of music, to use only the Arabic numerals to express chords. Thus the common chord they denote by $\begin{smallmatrix}8\\5\\3\end{smallmatrix}$ or $\begin{smallmatrix}3\\8\\5\end{smallmatrix}$ or $\begin{smallmatrix}5\\3\\8\end{smallmatrix}$, &c. and when sharps or flats occur annexed to these, in figuring thorough-bass, these last generally have reference to the sharps or flats affixed to the beginning of the piece or stave, usually called its signature; but they are not in the habit of distinguishing the major from the minor intervals, that enter into the composition of chords, by particular marks, though the same is often much wanted. The Rev. Henry Liston, in his *Essay on Perfect Intonation*, p. 50, has in some degree remedied this defect, by the use of the Arabic numerals, 2, 3, 4, 5, 6, 7, and 8, for the minor intervals of these names, and the Roman numerals, I, II, III, IV, V, VI, VII, and VIII, for the major intervals; by the use of ♭, affixed to these Arabic numerals, to denote the depression or lessening of a minor interval, either a medium or a minor semitone, S or S (see our Table of Intervals, Plate XXX. in Vol. II. ;) by adding ✱ to the Roman numerals, to denote the elevation or enlarging of a major interval, by S or S, according to their places in the scale; and by using also the *grave* and *acute* marks, ` and ′, affixed likewise to the numerals, to denote the depression or elevation of a major comma C. Thus the chord called the common chord is marked, $\begin{matrix}\mathrm{V}\\\mathrm{III}\end{matrix}$ or $\begin{matrix}\mathrm{VI}\\4\end{matrix}$ or $\begin{matrix}6\\3\end{matrix}$, the octave being here understood. The chord of diminished seventh by $\begin{matrix}\flat 7\\5\\3\end{matrix}$, and its inversions by $\begin{matrix}\mathrm{IV}\\5\\5'\\\text{✱}\mathrm{VI}\end{matrix}$, $\begin{matrix}\mathrm{VI}'\\\mathrm{IV}\\3\\\mathrm{VIII}\end{matrix}$, and $\begin{matrix}\mathrm{VI}\\\mathrm{IV}\\\text{✱}\mathrm{II}\\\mathrm{VIII}\end{matrix}$, (page 90.) The redundant sixth by $\begin{matrix}\mathrm{V}\\\mathrm{III}\end{matrix}$, $\begin{matrix}\mathrm{VI}\\\mathrm{III}\end{matrix}$, and $\begin{matrix}\mathrm{V}\\\mathrm{III}\end{matrix}$, (page 99, &c.)

It were still, however, desirable, that the ambiguous or variable signification of ✱ and ♭ were avoided, in marking chords sometimes to mean S and sometimes S, as Mr Farey has shewn in the *Philosophical Magazine*, vol. xxxix. p. 375; especially as this use of these characters interferes with their established use in figuring bases. The ambiguity of the term major and minor, sometimes denoting S and sometimes S, is not a parallel case, as Mr Liston seems to infer, in his note, page 137; because it is only by an original defect, or a partial view in the framers of the nomenclature of intervals, that a minor and major third, for instance, had not separate and independent names; and the same ought not now to be imitated in coining new terms, or inventing marks, when the precise values of intervals being understood, it is unphilosophical and improper to mark or call the departure from *fixed terms*, as II, III, IV, &c. by the mark ✱ or term redundant, having each different significations (S and S,) or from 2, 3, 4, &c. by the mark ♭ or term diminished, sometimes measured by S and sometimes by S in such cases. It seems that Mr Liston was deterred from using the terms flat and sharp, (according to his marks,) instead of diminished and redundant, by the absurd and ambiguous language of those writers who still often use flat and sharp synonymously with minor and major, and say a flat third, or a sharp sixth, when they mean the minor or major of these respectively. In Mr Liston's work, already quoted, the values of the several intervals, in all the several chords that occur in composition, are distinctly marked as above, and their peculiarities of effect on the ear, as exhibited on the extended or harmonic scale of his organ, are pointed out, and appear to offer much new and curious speculation and use to the scientific and practical musician. (ε)

CHORDS, VIBRATION OF. See ACOUSTICS and VIBRATION.

CHORETRUM, a genus of plants of the class Pentandria, and order Monogynia. See BOTANY, p. 172; and Brown's *Prodromus*, &c. p. 359.

CHORLEY, a town of England in Lancashire, situated near the source of a rivulet called Chor, which, taking its rise from several springs to the east of the town, falls into the Yarrow, a large river which waters the south-east part of the township. The town, which is tolerably well built, is not distinguished by any public edifices of great importance. The parochial chapel, dedicated to St Lawrence, is ornamented with numerous figures and hieroglyphics, and is supposed to be of Saxon structure. The prison stands at the south end of the town; and there are several dissenting meeting-houses, a poor-house, a grammar school, six alms-houses, and several Sunday schools. The cotton manufacture is carried on here to a great extent, and nearly a third of the whole population are employed in it, and in bleaching, printing cottons, fustians, calicoes, and muslins. Numerous mills are put in motion by the Chor and the Yarrow, while extensive bleaching grounds and printfields occupy their banks. The trade of the place derives great benefit from two canals, viz. the Liverpool and Leeds direction, and the Lancaster canal. The principal productions of the vicinity, are coal, lead, and alum, marl, slate, and freestone of various kinds for flags and millstones. The court of the bishop of Chester is held here twice a year by proxy. According to the population returns in 1811, the parish of Chorley contains,

Inhabited houses	902
Families that occupy them	912
Families employed in agriculture	100
Do. in trade and manufactures	790
Males	2426
Females	2756
Total population	5182

(*w*)

CHOROIDES. See EYE and OPTICS.

CHORUS. See DRAMA and POETRY.

CHOSROES, or KORROES. See PERSIA.

CHRIST. See CHRISTIANITY.

CHRIST-CHURCH, a borough and market town in Hampshire, is pleasantly situated at the conflux of the Avon and Stour. The principal building in the town is the church, which is large and interesting. Parts of the old castle are still standing, which appear to be portions of the keep and of the state apartments. The hotel, which has been recently built, and is fitted up with every accommodation, commands a delightful prospect of the sea, and of the Needle Rocks at the west end of the Isle of Wight. There is here also a poor-house, and several friendly societies. The inhabitants are principally employed in two breweries, and in the salmon fishery. The lower classes of females employ themselves in knitting stockings, and children find employment from a manufacture of watch spring chains, which has been established a few years ago. According to the population returns in 1811, the borough contains,

Inhabited houses	303
Families	327
Do. employed in agriculture	28
Do. employed in trade	145
Males	682
Females	871
Total population	1553

(*w*)

CHRISTIAN I. II. III. IV. V. See DENMARK.

CHRISTIANA, SANTO. See MARQUESAS ISLES.

CHRISTIANA, a city and sea-port town of Norway, in the government of Aggerhuus, is situated at the extremity of a bay of the same name, which runs almost sixty miles up the country. It is covered with a number of islands of various sizes, filled with mountains rocks, and rising from the water in the most beautiful and picturesque forms.

The town, which covers a considerable extent of ground, is divided into the city and suburbs of Waterlandt, Peterwigen, and Fierdingen, the fortress of Aggerhuus, and the town of Opsloe. The city was rebuilt after a plan designed by Christian IV. in which the streets were at right angles to each other, and all of them 40 feet wide.

The town has thus a great appearance of elegance, which is increased by the cleanness with which it is kept. The principal public buildings and establishments are, a gymnasium or Latin school, the parish church, a house of correction, a bank, and a printing house. The Latin school, endowed by Christian IV. in 1635, is governed by an upper and under master, and three assistants. In 1784, it contained only 37 scholars. A collection of 6000 volumes, lately left to the town by M. Deichman, has laid the foundation of a public library. Many attempts have been made by Mr Anker, to establish a university in Christiana, but this wise plan has hitherto been prohibited. Such is the low state of literature, that there is not even a bookseller's shop in the town, and when any book is wanted, it is ordered from Copenhagen or Hamburgh. The castle of Aggerhuus, which stands on a rocky eminence on the west side of the bay, at a short distance from the town, is strong though small. The garrison in the time of war is 1000, but during peace it is reduced to 500.

"Christiana," says Mr Coxe, "has an excellent harbour, and carries on a considerable trade. The principal exports are tar, soap, iron, copper, planks, and deals; alum manufactured at Mr Cooper's works for about £3000; iron from the four works of Borum, Edswold, Narkedahl, and Ondahlen, £14,000; copper from Foldahl, £10,000; planks and deals, £90,000, principally to England.

The planks and deals are of superior estimation to those sent from America, Russia, and from the different parts of the Baltic, because the trees grow on the rocks, and are therefore firmer, more compact, and less liable to rot than the others, which chiefly shoot from a sandy or loamy soil. The planks are either red or white fir, or pine. The red wood is produced from the Scotch fir, and the white wood, which is in such a high estimation, from the spruce fir. This wood is the most demanded, because no country produces it in such quantities as this part of Norway. Each tree yields three pieces of timber eleven or twelve feet in length, and is usually sawed into three planks. A tree generally requires 70 or 80 years growth, before it arrives at the greatest perfection.

The environs of Christiana not yielding sufficient planks for exportation, the greater part of the timber is hewn in the inland country, and floated down the rivers and cataracts. Saw mills are used for the purpose of cutting the planks, but must be privileged, and can only cut a certain quantity. The proprietors are bound to declare on oath, that they have not exceeded that quantity; and if they do, the privilege is taken away, and the saw mill destroyed. There are 136 privileged saw mills at Christiana, of which 100 belong to the family of Anker. The quantity of planks permitted to be cut amounts to 20,000,000 standard deals, twelve feet long, and one inch and a quarter thick."

The greater part of the country round Christiana belongs to the inhabitants of the town. An account of the family of the Ankers, distinguished by their opulence, their hospitality, and their intelligence, and of the splendid prospects in the neighbourhood of Christiana, will be found at considerable length in Kuttner's *Travels through Denmark, Sweden*, &c. Let. vii., and also in Coxe's *Travels in Poland, Russia*, &c. vol. v. 5th edit. p. 24. The population of Christiana in 1801 was 9005. East longitude 10° 28′ 45″, and north latitude 59° 55′ 20″. (π)

CHRISTIANITY.

This article is confined to the evidences of Christianity.

1. It is not proposed by us in this article, to enter either into the history of the Christian religion, or into its morality and doctrines. These we leave to the articles ECCLESIASTICAL HISTORY and THEOLOGY. We propose to confine ourselves to what have been called the *Evidences of Christianity*; or to exhibit a general view of those arguments, which go to prove that the New Testament is the authentic record of an actual communication from God to man.

There are two ways of verifying a human message.

2. Were a verbal communication to come to us from a person at a distance, there are two ways in which we might try to satisfy ourselves, that this was a true communication, and that there was no imposition in the affair. We might either sit in examination upon the substance of the message; and then from what we knew of the person from whom it professed to come, judge whether it was probable that such a message would be sent by him; or we may sit in examination upon the credibility of the messengers.

The first way is by attending to the internal evidence of the message itself, and is often insufficient.

3. It is evident, that in carrying on the first examination, we might be subject to very great uncertainty. The professed author of the communication in question may live at such a distance from us, that we may never have it in our power to verify his message by any personal conversation with him. We may be so far ignorant of his character and designs, as to be unqualified to judge of the kind of communication that should proceed from him. To estimate aright the probable authenticity of the message from what we know of its author, would require an acquaintance with his plans, and views, and circumstances, of which we may not be in possession. We may bring the greatest degree of sagacity to this investigation; but then the highest sagacity is of no avail, when there is an insufficiency of data. Our ingenuity may be unbounded; but then we may want the materials. The principle which we assume may be untrue in itself, and therefore might be fallacious in its application.

The second is by attending to the credibility of the messenger, and is more to be depended on.

4. Thus, we may derive very little light from our first argument. But there is still a second in reserve,—the credibility of the messengers. We may be no judges of the kind of communication which is natural, or likely to proceed from a person with whom we are but imperfectly acquainted; but we may be very competent judges of the degree of faith that is to be reposed in the bearers of that communication. We may know and appretiate the natural signs of veracity. There is a tone and a manner characteristic of honesty, which may be both intelligible and convincing. There may be a concurrence of several messengers. There may be their substantial agreement. There may be the total want of any thing like concert or collusion among them. There may be their determined and unanimous perseverance, in spite of all the incredulity and all the opposition which they meet with. The subject of the communication may be most unpalatable to us; and we be so unreasonable, as

to wreck our unpleasant feelings upon the bearers of it. In this way, they may not only have no earthly interest to deceive us, but have the strongest inducement possible to abstain from insisting upon that message which they were charged to deliver. Last of all, as the conclusive seal of their authenticity, they may all agree in giving us a watchword, which we previously knew could be given by none but their master; and which none but his messengers could ever obtain the possession of. In this way, unfruitful as all our efforts may have been upon the first subject of examination, we may derive from the second the most decisive evidence, that the message in question is a real message, and was actually transmitted to us by its professed author.

The case of a message from God.

5. Now, this consideration applies in all its parts to a message from God. The argument for the truth of this message resolves itself into the same two topics of examination. We may sit in judgment upon the subject of the message; or we may sit in judgment upon the credibility of its bearers.

6. The first forms a great part of that argument for the truth of the Christian religion, which comes under the head of its *internal evidences*. The substance of the message is neither more nor less, than that particular scheme of the divine economy which is revealed to us in the New Testament; and the point of inquiry is, whether this scheme be consistent with that knowledge of God and his attributes which we are previously in possession of.

The first way of verifying a message still less applicable to such a case.

7. It appears to us, that no effectual argument can be founded upon this consideration. We are not enough acquainted with the designs or character of the being from whom the message professes to have come. Were the author of the message some distant and unknown individual of our own species, we would scarcely be entitled to found an argument upon any comparison of ours, betwixt the import of the message and the character of the individual, even though we had our general experience of human nature to help us in the speculation. Now, of the invisible God, we have no experience whatever. We are still further removed from all direct and personal observation of him or of his counsels. Whether we think of the eternity of his government, or the mighty range of its influence over the wide departments of nature and of providence, he stands at such a distance from us, as to make the management of his empire a subject inaccessible to all our faculties.

But the second way applicable to it in all its parts

8. It is evident, however, that this does not apply to the second topic of examination. The bearers of the message were beings like ourselves; and we can apply our safe and certain experience of man to their conduct and their testimony. We know too little of God, to found any argument upon the coincidence which we conceive to exist betwixt the subject of the message and our previous conceptions of its author. But we may know enough of man to pronounce upon the credibility of the messengers. Had they the manner and physiognomy of honest men? Was their testimony resisted, and did they persevere in it? Had they any interest in fabricating the message; or did they suffer in consequence of this perseverance? Did they suffer to such a degree, as to constitute a satisfying pledge of their integrity? Was there more than one messenger, and did they agree as to the substance of that communication which they made to the world? Did they exhibit any special mark of their office as the messengers of God; such a mark as none but God could give, and none but his approved messengers could obtain the possession of? Was this mark the power of working miracles; and were these miracles so obviously addressed to the senses, as to leave no suspicion of deceit behind them? These are questions which we feel our competency to take up, and to decide upon. They lie within the legitimate boundaries of human observation; and upon the solution of these do we rest the question of the truth of the Christian religion.

How the belief of those who first received the message can be transmitted to posterity.

9. This, then, is the state of the question with those to whom the message was originally addressed. They had personal access to the messengers; and the evidences of their veracity lay before them. They were the eye and ear-witnesses of those facts, which occurred at the commencement of the Christian religion and upon which its credibility rests. What met their observation must have been enough to satisfy them; but we live at the distance of nearly 2000 years, and is there enough to satisfy us? Those facts, which constitute the evidence for Christianity, might have been credible and convincing to them, if they really saw them; but is there any way by which they can be rendered credible and convincing to us, who only read of them? What is the expedient by which the knowledge and belief of the men of other times can be transmitted to posterity? Can we distinguish between a corrupt and a faithful transmission? Have we evidence before us, by which we can ascertain what was the belief of those to whom the message was first communicated? And can the belief which existed in their minds be derived to ours, by our sitting in judgment upon the reasons which produced it?

By written testimony.

10. The surest way in which the belief and knowledge of the men of former ages can be transmitted to their descendants, is through the medium of written testimony; and it is fortunate for us, that the records of the Christian religion are not the only historical documents which have come down to us. A great variety of information has come down to us in this way; and a great part of that information is as firmly believed, and as confidently proceeded upon, as if the thing narrated had happened within the limits of our eye-sight. No man doubts the invasion of Britain by Julius Cæsar; and no man doubts, therefore, that a conviction of the truth of past events may be fairly produced in the mind by the instrumentality of a written memorial. This is the kind of evidence which is chiefly appealed to for the truth of ancient history; and it is counted satisfying evidence for all that part of it which is received and depended upon.

It is upon this that our faith in all ancient history is founded.

11. In laying before the reader, then, the evidence for the truth of Christianity, we do not call his mind to any singular or unprecedented exercise of its faculties. We call him to pronounce upon the credibility of written documents, which profess to have been published at a certain age, and by certain authors. The inquiry involves in it no principle which is not appealed to every day in questions of ordinary criticism. To sit in judgment on the credibility of a written document, is a frequent and familiar exercise of the understanding with literary men. It is fortunate for the human mind, when so interesting a question as its religious faith can be placed under the tribunal of such evidence as it is competent to pronounce upon. It was fortunate for those to whom Christianity (a professed communication from heaven) was first addressed, that they could decide upon the genuineness of the communication by such familiar and everyday principles, as the marks of truth or falsehood in the human bearers of that communication. And it is fortunate for us, that when, after that communication has assumed the form of a historical document, we can pronounce upon the degree of credit which should be at-

tached to it, by the very same exercise of mind which we so confidently engage in, when sitting in examination upon the other historical documents that have come down to us from antiquity.

There is a peculiar impression given to the testimony, when its subject is a fact connected with religion.

12. If two historical documents possess equal degrees of evidence, they should produce equal degrees of conviction. But if the object of the one be to establish some fact connected with our religious faith, while the object of the other is to establish some fact, about which we feel no other interest, than that general curiosity which is gratified by the solution of any question in literature, this difference in the object, produces a difference of effect in the feelings and tendencies of the mind. It is impossible for the mind, while it enquires into the evidence of a Christian document, to abstain from all reference to the important conclusion of the enquiry. And this will necessarily mingle its influence with the arguments which engage its attention. It may be of importance to attend to the peculiar feelings which are thus given to the investigation, and in how far they have affected the impression of the Christian argument.

It may lead some to over rate the strength of the testimony,

13. We know it to be the opinion of some, that in this way an undue advantage has been given to that argument. Instead of a pure question of truth, it has been made a question of sentiments, and the wishes of the heart have mingled with the exercise of the understanding. There is a class of men who may feel disposed to overrate its evidences, because they are anxious to give every support and stability to a system, which they conceive to be most intimately connected with the dearest hopes and wishes of humanity; because their imagination is carried away by the sublimity of its doctrines, or their heart engaged by that amiable morality which is so much calculated to improve and adorn the face of society.

14. Now, we are ready to admit, that as the object of the inquiry is not the character, but the truth of Christianity, the philosopher should be careful to protect his mind from the delusion of its charms; he should separate the exercise of the understanding from the tendencies of the fancy or of the heart. He should be prepared to follow the light of evidence, though it may lead him to conclusions the most painful and melancholy. He should train his mind to all the hardihood of abstract and unfeeling intelligence. He should give up every thing to the supremacy of argument, and be able to renounce, without a sigh, all the tenderest prepossessions of infancy, the moment that truth demands of him the sacrifice. Let it be remembered, however, that while one species of prejudice operates in favour of Christianity, another prejudice operates against it. There is a class of men who are repelled from the investigation of its evidences, because in their minds Christianity is allied with the weakness of superstition; and they feel that they are descending, when they bring down their attention to a subject which engrosses so much respect and admiration from the vulgar.

and others to underrate it;

but, upon the whole, it is unfavourable.

15. It appears to us, that the peculiar feeling which the sacredness of the subject gives to the enquirer, is unfavourable to the impression of the Christian argument. Had the subject not been sacred, and had the same testimony been given to the facts that are connected with it, we are satisfied, that the history of Jesus in the New Testament, would have been looked upon as the best supported by evidence of any history that has come down to us. It would assist us in appreciating the evidence for the truth of the gospel history, if we could conceive for a moment, that Jesus, instead of being the founder of a new religion, had been merely the founder of a new school of philosophy, and that the different histories which have come down to us, had merely represented him as an extraordinary person, who had rendered himself illustrious among his countrymen by the wisdom of his sayings, and the beneficence of his actions. We venture to say, that had this been the case, a tenth part of the testimony which has actually been given, would have been enough to satisfy us. Had it been a question of mere erudition, where neither a predilection in favour of a religion, nor an antipathy against it, could have impressed a bias in any one direction, the testimony, both in weight and in quantity, would have been looked upon as quite unexampled in the whole compass of ancient literature.

16. To form a fair estimate of the strength and decisiveness of the Christian argument, we should, if possible, divest ourselves of all reference to religion, and view the truth of the gospel history, purely as a question of erudition. If at the outset of the investigation we have a prejudice against the Christian religion, the effect is obvious; and without any refinement of explanation, we see at once how such a prejudice must dispose us to annex suspicion and distrust to the testimony of the Christian writers. But even when the prejudice is on the side of Christianity, the effect is unfavourable on a mind that is at all scrupulous about the rectitude of its opinions. In these circumstances, the mind gets suspicious of itself. It feels a predilection, and becomes apprehensive lest this predilection may have disposed it to cherish a particular conclusion, independently of the evidences by which it is supported. Were it a mere speculative question, in which the interests of man, and the attachments of his heart, had no share, he would feel greater confidence in the result of his investigation. But it is difficult to separate the moral impressions of piety, and it is no less difficult to calculate their precise influence on the exercises of the understanding. In the complex sentiment of attachment and conviction, which he annexes to the Christian religion, he finds it difficult to say, how much is due to the tendencies of the heart, and how much is due to the pure and unmingled influence of argument. His very anxiety for the truth, disposes him to narrate the circumstances which give a bias to his understanding, and through the whole process of the enquiry, he feels a suspicion and an embarrassment, which he would not have felt, had it been a question of ordinary erudition.

17. The same suspicion which he attaches to himself, he will be ready to attach to all whom he conceives to be in similar circumstances. Now, every author who writes in defence of Christianity is supposed to be a Christian; and this, in spite of every argument to the contrary, has the actual effect of weakening the impression of his testimony. This suspicion affects, in a more remarkable degree, the testimony of the first writers on the side of Christianity. In opposition to it, you have no doubt, to allege the circumstances under which the testimony was given; the tone of sincerity which runs through the performance of the author, the concurrence of other testimonies; the persecutions which were sustained in adhering to them, and which can be accounted for on no other principle, than the power of conscience and conviction; and the utter impossibility of imposing a false testimony on the world, had they even been disposed to do it. Still there is a lurking suspicion, which often survives all this strength of argument, and which it is difficult to get rid of, even after it has been demonstrated to be completely unreasonable. He is a Christian. He is one of the party. Am I an infidel? I persist in distrusting the testimony. Am I a Christian? I rejoice in the strength of it; but this very joy becomes matter of sus-

picion to a scrupulous enquirer. He feels something more than the concurrence of his belief in the testimony of the writer. He catches the infection of his piety and his moral sentiments. In addition to the acquiescence of the understanding, there is a *con amore* feeling both in himself, and in his author, which he had rather been without, because he finds it difficult to compute the precise amount of its influence; and the consideration of this restrains him from that clear and decided conclusion, which he would infallibly have landed in, had it been purely a secular investigation.

The very sacredness of the subject, has thrown a disguise over the strength of the Christian testimony.

18. There is something in the very sacredness of the subject, which intimidates the understanding, and restrains it from making the same firm and confident application of its faculties, which it would have felt itself perfectly warranted to do, had it been a question of ordinary history. Had the apostles been the disciples of some eminent philosopher, and the fathers of the church, their immediate successors in the office of presiding over the discipline and instruction of the numerous schools which they had established, this would have given a secular complexion to the argument, which we think would have been more satisfying to the mind, and have impressed upon it a closer and more familiar conviction of the history in question. We should have immediately brought it into comparison with the history of other philosophers, and could not have failed to recognize, that, in minuteness of information, in weight and quantity of evidence, in the concurrence of numerous and independent testimonies, and in the total absence of every circumstance that should dispose us to annex suspicion to the account which lay before us, it far surpassed any thing that had come down to us from antiquity. It so happens, however, that, instead of being the history of a philosopher, it is the history of a prophet. The veneration we annex to the sacredness of such a character, mingles with our belief in the truth of his history. From a question of simple truth, it becomes a question in which the heart is interested; and the subject from that moment assumes a certain holiness and mystery, which veils the strength of the argument, and takes off from that familiar and intimate conviction which we annex to the far less authenticated histories of profane authors.

And however strong an argument may be, the mere fact of its being much questioned, leaves a feeling that it is very questionable.

19. It may be further observed, that every part of the Christian argument has been made to undergo a most severe scrutiny. The same degree of evidence which, in questions of ordinary history, commands the easy and universal acquiescence of every inquirer, has, in the subject before us, been taken most thoroughly to pieces, and pursued, both by friends and enemies, into all its ramifications. The effect of this is unquestionable. The genuineness and authenticity of the profane historian, are admitted upon much inferior evidence to what we can adduce for the different pieces which make up the New Testament: And why? because the evidence has been hitherto thought sufficient, and the genuineness and authenticity have never been questioned. Not so with the gospel history. Though its evidence is precisely the same in kind, and vastly superior in degree to the evidence for the history of the profane writer, its evidence has been questioned, and the very circumstance of its being questioned has annexed a suspicion to it. At all points of the question, there has been a struggle and a controversy. Every ignorant objection, and every rash and petulant observation, has been taken up and commented upon by the defenders of Christianity. There has at last been so much said about it, that a general feeling of insecurity is apt to accompany the whole investigation. There has been so much fighting, that Christianity is now looked upon as debateable ground. Other books, where the evidence is much inferior, but which have had the advantage of never being questioned, are received as of established authority. It is striking to observe the perfect confidence with which an infidel will quote a passage from an ancient historian. He perhaps does not overrate the credit due to him. But present him with a tabellated and comparative view of all the evidences that can be adduced for the gospel of Matthew, and any profane historian which he chooses to fix upon, and let each distinct evidence be discussed upon no other principle than the ordinary and approved principle of criticism, we assure him that the sacred history would far outweigh the profane in the number and value of its testimonies.

Examples of the above remarks.

20. In illustration of the above remarks, we can refer to the experience of those who have attended to this examination. We ask them to recollect the satisfaction which they felt, when they came to those parts of the examination, where the argument assumes a secular complexion. Let us take the testimony of Tacitus for an example. He asserts the execution of our Saviour in the reign of Tiberius, and under the procuratorship of Pilate; the temporary check which this gave to his religion; its revival, and the progress it had made, not only over Judea, but to the city of Rome. Now all this is attested in the Annals of Tacitus. But it is also attested in a far more direct and circumstantial manner in the annals of another author, in a book entitled the *History of the Acts of the Apostles by the Evangelist Luke.* Both of these performances carry on the very face of them the appearance of unsuspicious and well-authenticated documents. But there are several circumstances, in which the testimony of Luke possesses a decided advantage over the testimony of Tacitus. He was the companion of these very apostles. He was an eye-witness to many of the events recorded by him. He had the advantage over the Roman historian in time and in place, and in personal knowledge of many of the circumstances in his history. The genuineness of his publications, too, and the time of its appearance, are far better established, and by precisely that kind of argument which is held decisive in every other question of erudition. Besides all this, we have the testimony of at least five of the Christian fathers, all of whom had the same, or a greater, advantage in point of time than Tacitus, and who had a much nearer and readier access to original sources of information. Now, how comes it that the testimony of Tacitus, a distant and later historian, should yield such delight and satisfaction to the inquirer, while all the antecedent testimony (which, by every principle of approved criticism, is much stronger than the other,) should produce an impression that is comparatively languid and ineffectual? It is owing, in a great measure, to the principle which we have already alluded to. There is a sacredness annexed to the subject, so long as it is under the pen of fathers and evangelists, and this very sacredness takes away from the freedom and confidence of the argument. The moment that it is taken up by a profane author, the spell which held the understanding in some degree of restraint is dissipated. We now tread on the more familiar ground of ordinary history; and the evidence for the truth of the gospel appears more assimilated to that evidence, which brings home to our conviction the particulars of the Greek and Roman story.

21. To say that Tacitus was upon this subject a disinterested historian, is not enough to explain the preference which you give to his testimony. There is no subject in which the triumph of the Christian argument is more conspicuous, than the moral qualifications which

give credit to the testimony of its witnesses. We have every possible evidence, that there could be neither mistake nor falsehood in their testimony; a much greater quantity of evidence, indeed, than can actually be produced to establish the credibility of any other historian. Now all we ask is, that where an exception to the veracity of any historian is removed, you restore him to that degree of credit and influence which he ought to have possessed, had no such exception been made. In no case has an exception to the credibility of an author been more triumphantly removed, than with the early Christian writers; and yet, as a proof that there really exists some such delusion as we have been labouring to establish, though our eyes are perfectly open to the integrity of the Christian witnesses, there is still a disposition to give the preference to the secular historian. When Tacitus is placed by the side of the evangelist Luke, even after the decisive argument which establishes the credit of the latter historian has convinced the understanding, there remains a tendency in the mind to annex a confidence to the account of the Roman writer, which is altogether disproportioned to the relative merits of his testimony.

22. Let us suppose, for the sake of further illustration, that Tacitus had included some more particulars in his testimony, and that, in addition to the execution of our Saviour, he had asserted, in round and unqualified terms, that this said Christus had risen from the dead, and was seen alive by some hundreds of his acquaintances. Even this would not have silenced altogether the cavils of enemies, but it would have reclaimed many an infidel; been exulted in by many a sincere Christian; and made to occupy a foremost place in many a book upon the evidences of our religion. Are we to forget all the while, that we are in actual possession of much stronger testimony? that we have the concurrence of eight or ten cotemporary authors, most of whom had actually seen Christ after the great event of his resurrection? that the veracity of these authors, and the genuineness of their respective publications, are established on grounds much stronger than have ever been alleged in behalf of Tacitus, or any ancient author? Whence this unaccountable preference of Tacitus? Upon every received principle of criticism, we are bound to annex greater confidence to the testimony of the apostles. It is vain to recur to the imputation of its being an interested testimony. This the apologists for Christianity undertake to disprove, and actually have disproved it, and that by a much greater quantity of evidence than would be held perfectly decisive in a question of common history. If after this there should remain any lurking sentiment of diffidence or suspicion, it is entirely resolvable into some such principle as I have already alluded to. It is to be treated as a mere feeling,—a delusion which should not be admitted to have any influence on the convictions of the understanding.

23. The principle which we have been attempting to expose, is found, in fact, to run through every part of the argument, and to accompany the enquirer through all the branches of the investigation. The authenticity of the different books of the New Testament forms a very important enquiry, wherein the object of the Christian apologist is to prove that they were really written by their professed authors. In proof of this, there is an uninterrupted series of testimony from the days of the apostles; and it was not to be expected, that a point so isoteric to the Christian society could have attracted the attention of profane authors, till the religion of Jesus, by its progress in the world, had rendered itself conspicuous. It is not then till about eighty years after the publication of the different pieces, that we meet with the testimony of Celsus, an avowed enemy to Christianity, and who asserts, upon the strength of its general notoriety, that the historical parts of the New Testament were written by the disciples of our Saviour. This is very decisive evidence. But how does it happen, that it should throw a clearer gleam of light and satisfaction over the mind of the enquirer, than he had yet experienced in the whole train of his investigation? Whence that disposition to underrate the antecedent testimony of the Christian writers? Talk not, of their's being an interested testimony; for, in point of fact, the same disposition operates, after reason is convinced that the suspicion is totally unfounded. What we contend for is, that this indifference to the testimony of the Christian writers implies a dereliction of principles, which we apply with the utmost confidence to all similar enquiries.

24. The effects of this same principle are perfectly discernible in the writings of even our most judicious apologists. We offer no reflection against the worthy and meritorious Lardner, who, in his credibility of the gospel history, presents us with a collection of testimonies which should make every Christian proud of his religion. In his evidence for the authenticity of the different pieces which make up the New Testament, he begins with the oldest of the fathers, some of whom were the intimate companions of the original writers. According to our view of the matter, he should have dated the commencement of his argument from a higher point, and begun with the testimonies of these original writers to one another. In the second Epistle of Peter, there is a distinct reference made to the writings of Paul, and in the Acts of the Apostles, there is a reference made to one of the four gospels. Had Peter, instead of being an apostle, ranked only with the fathers of the church, and had his epistle not been admitted into the canon of scripture; this testimony of his would have had a place in the catalogue, and been counted peculiarly valuable, both for its precision and its antiquity. There is certainly nothing in the estimation he enjoyed, or in the circumstances of his epistle being bound up with the other books of the New Testament, which ought to impair the credit of his testimony. But in effect, his testimony does make a weaker impression on the mind, than a similar testimony from Barnabas, or Clement, or Polycarp. It certainly ought not to do it, and there is a delusion in the preference that is thus given to the latter writers. It is in fact another example of the principle which we have been so often insisting upon. What profane authors are in reference to Christian authors at large, the fathers of the church are in reference to the original writers of the New Testament. In contradiction to every approved principle, we prefer the distant and the later testimony, to the testimony of writers, who carry as much evidence and legitimate authority along with them, and who only differ from others in being nearer the original sources of information. We neglect and undervalue the evidence which the New Testament itself furnishes, and rest the whole of the argument upon the external and superinduced testimony of subsequent authors.

25. A great deal of all this is owing to the manner in which the defence of Christianity has been conducted by its friends and supporters. They have given too much in to the suspicions of the opposite party. They have yielded their minds to the infection of their scepticism, and maintained, through the whole process, a caution and a delicacy which they often carry to an excessive degree; and by which, in fact, they have done injustice to their own arguments. Some of them begin

with the testimony of Tacitus as a first principle, and pursue the investigation upwards, as if the evidence that we collect from the annals of the Roman historian were stronger than that of the Christian writers who flourished nearer the scene of the investigation, and whose credibility can be established on grounds which are altogether independent of his testimony. In this way, they come at last to the credibility of the New Testament writers, but by a lengthened and circuitous procedure. The reader feels as if the arguments were diluted at every step in the process of derivation, and his faith in the gospel history is much weaker than his faith in histories that are far less authenticated. Bring Tacitus and the New Testament to an immediate comparison, and subject them both to the touchstone of ordinary and received principles, and it will be found that the latter leaves the former out of sight in all the marks, and characters, and evidences of an authentic history. The truth of the gospel stands on a much firmer and more independent footing, than many of its defenders would dare to give us any conception of. They want that boldness of argument which the merits of the question entitle them to assume. They ought to maintain a more decided front to their adversaries, and tell them, that, in the New Testament itself—in the concurrence of its numerous, and distant, and independent authors—in the uncontradicted authority which it has maintained from the earliest times of the church—in the total inability of the bitterest adversaries of our religion to impeach its credibility—in the genuine characters of honesty and fairness which it carries on the very face of it, that in these, and in every thing else, which can give validity to the written history of past times, there is a weight and a splendour of evidence, which the testimony of Tacitus cannot confirm, and which the absence of that testimony could not have diminished.

26. If it were necessary, in a court of justice, to ascertain the circumstances of a certain transaction which happened in a particular neighbourhood, the obvious expedient would be to examine the agents and the eye-witnesses of that transaction. If six or eight concurred in giving the same testimony—if there was no appearance of collusion amongst them—if they had the manner and aspect of creditable men—above all, if this testimony were made public, and not a single individual, from the numerous spectators of the transaction alluded to, stept forward to falsify it, then, we apprehend, the proof would be looked upon as complete. Other witnesses might be summoned from a distance to give in their testimony, not of what they saw, but of what they heard upon the subject; but their concurrence, though a happy enough circumstance, would never be looked upon as any material addition to the evidence already brought forward. Another court of justice might be held in a distant country, and years after the death of the original witnesses. It might have occasion to verify the same transaction, and for this purpose might call in the only evidence which it was capable of collecting—the testimony of men who lived after the transaction in question, and at a great distance from the place where it happened. There would be no hesitation, in ordinary cases, about which of the two testimonies ought to be preferred; and the record of the first court could be appealed to by posterity as by far the more valuable document, and far more decisive of the point in controversy. Now, what we complain of, is, that in the instance before us, this principle is reversed. The reports of hearsay witnesses is held in higher estimation than the reports of the original agents and spectators. The most implicit credit is given to the testimony of the distant and later historians, and the testimony of the original witnesses is received with as much distrust as if they carried the marks of villany and imposture upon their foreheads. The genuineness of the first record can be established by a much greater weight and variety of evidence, than the genuineness of the second. Yet all the suspicion that we feel upon this subject annexes to the former; and the apostles and evangelists, with every evidence in their favour which it is in the power of testimony to furnish, are, in fact, degraded from the place which they ought to occupy among the accredited historians of past times.

27. The above observations may help to prepare the enquirer for forming a just and impartial estimate of the merits of the Christian testimony. His great object should be to guard against every bias of the understanding. The general idea is, that a predilection in favour of Christianity may lead him to overrate the argument. We believe that if every unfair tendency of the mind could be subjected to a rigorous computation, it would be found that the combined operation of them all has the effect of impressing a bias in a contrary direction. All we wish for, is, that the arguments which are held decisive in other historical questions, should not be looked upon as nugatory when applied to the investigation of those facts which are connected with the truth and establishment of the Christian religion, that every prepossession should be swept away, and room left for the understanding to expatiate without fear, and without incumbrance.

Division of the argument into four points.

28. The argument for the truth of the different facts recorded in the gospel history, resolves itself into four parts. In the first, it shall be our object to prove, that the different pieces which make up the New Testament, were written by the authors whose names they bear, and at the age which is commonly assigned to them. In the second, we shall exhibit the internal marks of truth and honesty which may be gathered from the compositions themselves. In the third, we shall press upon the reader the known situation and history of the authors, as satisfying proofs of the veracity with which they delivered themselves. And, in the fourth part, we shall lay before them the additional and subsequent testimonies, by which the narrative of the original writers is supported.

29. In every point of the investigation, we shall meet with examples of the principle which we have already alluded to. We have said, that if two distinct enquiries be set on foot, where the object of the one is to settle some point of sacred history, and the object of the other is to settle some point of profane history; the mind acquiesces in a much smaller quantity of evidence in the latter case than it does in the former. If this be right, (and to a certain degree it undoubtedly is), then it is incumbent on the defender of Christianity to bring forward a greater quantity of evidence than would be deemed sufficient in a question of common literature, and to demand the acquiescence of his reader upon the strength of this superior evidence. If it be not right beyond a certain degree—and if there be a tendency in the mind to carry it beyond that degree, then this tendency is founded upon a delusion, and it is well that the reader should be apprised of its existence, that he may protect himself from its influence. The superior quantity of evidence which we can bring forward will, in this case, all go to augment the positive effects upon his convictions; and he will rejoice to perceive, that he is far safer in believing what has been handed down to him of the history of Jesus Christ, and the doctrine of his apostles, than in be-

lieving what he has never doubted—the history of Alexander, and the doctrine of Socrates. Could all the marks of veracity, and the list of subsequent testimonies, be exhibited to the eye of the reader in parallel columns, it would enable him, at one glance, to form a complete estimate. We shall have occasion to call his attention to this so often, that we may appear to many of our readers to have expatiated upon our introductory principle to a degree that is tiresome and unnecessary. We conceive, however, that it is the best and most perspicuous way of putting the argument.

The authenticity of the pieces which make up the New Testament.

30. I. The different pieces which make up the New Testament, were written by the authors whose names they bear, and at the time which is commonly assigned to them.

The principles upon which we annex credit to the written memorials of past ages.

31. After the long slumber of the middle ages, the curiosity of the human mind was awakened, and felt its attention powerfully directed to those old writings which have survived the waste of so many centuries. It were a curious speculation to ascertain the precise quantity of evidence which lay in the information of these old documents. And it may help us in our estimate, first to suppose, that in the researches of that period, there was only one composition found which professed to be a narrative of past times. A number of circumstances can be assigned, which might give a certain degree of probability to the information even of this solitary and unsupported document. There is, first, the general consideration, that the principle upon which a man feels himself induced to write a true history, is of more frequent and powerful operation, than the principle upon which a man feels himself induced to offer a false or a disguised representation of facts to the world. This affords a general probability on the side of the document in question being a true narrative; and there may be some particulars connected with the appearance of the performance itself, which might strengthen this probability.

The case supposed of there being only one written memorial of past times.

We may not be able to discover in the story itself any inducement which the man could have in publishing it, if it were mainly and substantially false. We might see an expression of honesty, which it is in the power of written language, as well as of spoken language, to convey. We might see that there was nothing monstrous or improbable in the narrative itself. And, without enumerating every particular calculated to give it the impression of truth, we may, in the progress of our inquiries, have ascertained, that copies of this manuscript were to be found in many places, and in different parts of the world, proving, by the evidence of its diffusion, the general esteem in which it was held by the readers of past ages. This gives us the testimony of these readers to the value of the performance; and as we are supposing it a history, and not a work of imagination, it could only be valued on the principle of its being true information which was laid before them. In this way, a solitary document, transmitted to us from a remote antiquity, might gain credit in the world, though it had been lost sight of for many ages, and only brought to light by the revival of a literary spirit, which had lain dormant during a long period of history.

The supposition extended to two, three, and a greater number.

32. We can farther suppose, that, in the progress of these researches, another manuscript was discovered, having the same characters, and possessing the same separate and original marks of truth with the former. If they both touched upon the same period of history, and gave testimony to the same events, it is plain that a stronger evidence for the truth of these events would be afforded, than what it was in the power of either of the testimonies taken separately to supply. The separate circumstances which gave a distinct credibility to each of the testimonies, are added together, and give a so much higher credibility to those points of information upon which they deliver a common testimony. This is the case when the testimonies carry in them the appearance of being independent of one another. And even when the one is derived from the other, it still affords an accession to the evidence, because the author of the subsequent testimony gives us the distinct assertion, that he believed in the truth of the original testimony.

33. The evidence may be strengthened still farther, by the accession of a third manuscript, and a third testimony. All the separate circumstances which confer credibility upon any one document, even though it stands alone and unsupported by any other, combine themselves into a much stronger body of evidence, when we have obtained the concurrence of several. If, even in the case of a single narrative, a probability lies on the side of its being true, from the multitude and diffusion of copies, and from the air of truth and honesty discernible in the composition itself, the probability is heightened by the coincidence of several narratives, all of them possessing the same claims upon our belief. If it be improbable that one should be written for the purpose of imposing a falsehood upon the world, it is still more improbable that many should be written, all of them conspiring to the same perverse and unnatural objects. No one can doubt, at least, that of the multitude of written testimonies which have come down to us, the true must greatly preponderate over the false; and that the deceitful principle, though it exists sometimes, would never operate to such an extent, as to carry any great or general imposition in the face of all the documents which are before us.

The strong evidence we possess for many points of ancient history.

The supposition must be extended much farther than we have yet carried it, before we reach the degree of evidence and of testimony, which, on many points of ancient history, we are at this moment in actual possession of. Many documents have been collected, professing to be written at different times, and by men of different countries. In this way, a great body of ancient literature has been formed, from which we can collect many points of evidence, too tedious to enumerate. Do we find the express concurrence of several authors to the same piece of history? Do we find, what is still more impressive, events formally announced in one narrative, not told over again, but implied and proceeded upon as true in another? Do we find the succession of history, through a series of ages, supported in a way that is natural and consistent? Do we find these compositions which profess a higher antiquity, appealed to by those which profess a lower? These, and a number of other points, which meet every scholar who betakes himself to the actual investigation, give a most warm and living character of reality to the history of past times. There is a perversity of mind which may resist all this. There is no end to the fancies of scepticism. We may plead in vain the number of written testimonies; their artless coincidence, and the perfect undesignedness of manner by which they often supply the circumstances that serve both to guide and satisfy the inquirer, and to throw light and support upon one another. The infidel will still have something, behind which he can entrench himself; and his last supposition, monstrous and unnatural as it is, may be, that the whole of written history is a laborious fabrication, sustained for many ages, and concurred in by many individuals, with no other purpose than to enjoy the anticipated blunders of the men of future times, whom they had combined with so much dexterity to bewilder and lead astray.

Historical evidence has its true principles.

34. If it were possible to summon up to the presence of the mind, the whole mass of spoken testimony, it would be found that what was false bore a very small proportion to what was true. For many obvious reasons, the proportion of the false to the true must be also small in written testimony. Yet instances of falsehood occur in both; and the actual ability to separate the false from the true in written history, proves that historical evidence has its principles and its probabilities to go upon. There may be the natural signs of dishonesty. There may be the wildness and improbability of the narrative. There may be a total want of agreement on the part of other documents. There may be the silence of every author for ages after the pretended date of the manuscript in question. There may be all these, in sufficient abundance, to convict the manuscript of forgery and falsehood. This has actually been done in several instances. The skill and discernment of the human mind upon the subject of historical evidence, have been improved by the exercise. The few cases in which sentence of condemnation has been given, are so many testimonies to the competency of the tribunal which has sat in judgment over them, and give a stability to their verdict, when any document is approven of. It is a peculiar subject, and the men who stand at a distance from it may multiply their suspicions and their scepticism at pleasure; but no intelligent man ever entered into the details, without feeling the most familiar and satisfying conviction of that credit and confidence, which it is in the power of historical evidence to bestow.

35. Now to apply this to the object of our present division, which is to ascertain the age of the document, and the person who is the author of it. These are points of information which may be collected from the performance itself. They may be found in the body of the composition, or they may be more formally announced in the title-page—and every time that the book is referred to by its title, or the name of the author and age of the publication are announced in any other document that has come down to us, these points of information receive additional proof from the testimony of subsequent writers.

These applied to the determination of past matters of fact.

36. The New Testament is bound up in one volume, but we would be underrating its evidence if we regarded it only as one testimony, and that the truth of the facts recorded in it rested upon the testimony of one historian. It is not one publication, but a collection of several publications, which are ascribed to different authors, and made their first appearance in different parts of the world. To fix the date of their appearance, it is necessary to institute a separate inquiry for each publication; and it is the unexcepted testimony of all subsequent writers, that two of the gospels, and several of the epistles, were written by the immediate disciples of our Saviour, and published in their lifetime. Celsus, an enemy of the Christian faith, refers to the affairs of Jesus as written by his disciples. He never thinks of disputing the fact; and from the extracts which he makes for the purpose of criticism, there can be no doubt in the mind of the reader, that it is one or other of the four gospels to which he refers. The single testimony of Celsus may be considered as decisive of the fact, that the story of Jesus and of his life was actually written by his disciples. Celsus writes about a hundred years after the alleged time of the publication of this story; but that it was written by the companions of this Jesus, is a fact which he never thinks of disputing. He takes it up upon the strength of its general notoriety, and the whole history of that period furnishes nothing that can attach any doubt or suspicion to this circumstance. Referring to a principle already taken notice of, had it been the history of a philosopher instead of a prophet, its authenticity would have been admitted without any formal testimony to that effect. It would have been admitted, so to speak, upon the mere existence of the title-page, combined with this circumstance, that the whole course of history or tradition does not furnish us with a single fact, leading us to believe that the correctness of this title-page was ever questioned. It would have been admitted, not because it was asserted by subsequent writers, but because they made no assertion upon the subject, because they never thought of converting it into a matter of discussion, and because their occasional references to the book in question would be looked upon as carrying in them a tacit acknowledgment, that it was the very same book which it professed to be at the present day. The distinct assertion of Celsus, that the pieces in question were written by the companions of Jesus, though even at the distance of 100 years, is an argument in favour of their authenticity which cannot be alleged for many of the most esteemed compositions of antiquity. It is the addition of a formal testimony to that kind of general evidence, which is founded upon the tacit or implied concurrence of subsequent writers, and which is held to be perfectly decisive in similar cases.

The matters of fact involved in the authenticity of the New Testament, are the times of its appearance and the authors by whom it was written.

The testimony of Celsus to these matters of fact.

The nearer and more valuable testimonies of the Christian writers.

37. Had the pieces, which make up the New Testament, been the only documents of past times, the mere existence of a pretension to such an age, and to such an author, resting on their own information, would have been sustained as a certain degree of evidence, that the real age and the real author had been assigned to them. But we have the testimony of subsequent authors to the same effect; and it is to be remarked, that it is by far the most crowded, and the most closely sustained series of testimonies, of which we have any example in the whole field of ancient history. When we assigned the testimony of Celsus, it is not to be supposed that this is the very first which occurs after the days of the apostles. The blank of a hundred years betwixt the publication of the original story and the publication of Celsus, is filled up by antecedent testimonies, which, in all fairness, should be counted more decisive of the point in question. They are the testimonies of Christian writers, and, in as far as a nearer opportunity of obtaining correct information is concerned, they should be held more valuable than the testimony of Celsus. In some cases, their reference to the books of the new Testament is made in the form of an express quotation, and the author particularly named. In other cases, the quotation is made without reference to the particular author, and ushered in by the general words, "*as it is written*." And besides, there are innumerable allusions to the different parts of the New Testament, scattered over all the writings of the earlier fathers. In this last case, there is no express citation; but we have the sentiment, the term of expression, the very words of the New Testament repeated so often, and by such a number of different writers, as to leave no doubt upon the mind, that they were copied from one common original, which was at that period held in high reverence and estimation. In pursuing the train of references, we do not meet with a single chasm from the days of the original writers. Not to repeat what we have already made some allusion to, the testimonies of the original writers to one another, we proceed to assert, that some of the fathers, whose wri-

tings have come down to us, were the companions of the apostles, and are even named in the books of the New Testament. St Clement, bishop of Rome, is, with the concurrence of all ancient authors, the same whom Paul mentions in his epistle to the Philippians. In his epistle to the church of Corinth, which was written in the name of the whole church of Rome, he refers to the first epistle of Paul to the former church. "Take into your hands the epistle of the blessed Paul the apostle." He then makes a quotation, which is to be found in Paul's first epistle to the Corinthians. Could Clement have done this to the Corinthians themselves, had no such epistle been in existence? And is not this an undoubted testimony, not merely from the mouth of Clement, but on the part of the churches both of Rome and Corinth, to the authenticity of such an epistle? There are in this same epistle of Clement, several quotations of the second kind, which confirm the existence of some other books of the New Testament; and a multitude of allusions or references of the third kind, to the writings of the evangelists, the Acts of the Apostles, and a great many of these epistles which have been admitted into the New Testament. We have similar testimonies from some more of the fathers, who lived and conversed with Jesus Christ. Besides many references of the second and third kind, we have also other instances of the same kind of testimony which Clement gave to St Paul's first epistle to the Corinthians, than which nothing can be conceived more indisputable. Ignatius, writing to the church of Ephesus, takes notice of St Paul's epistle to that church; and Polycarp, an immediate disciple of the apostles, makes the same express reference to St Paul's epistle to the Philippians, in a letter addressed to that people. In carrying our attention down from the apostolical fathers, we follow an uninterrupted series of testimonies to the authenticity of the canonical scriptures. They get more numerous and circumstantial as we proceed,—a thing to be expected from the progress of Christianity, and the greater multitude of writers, who come forward in its defence and illustration.

38. In pursuing the series of writers, from the days of the apostles down to about 150 years after the publication of the pieces which make up the New Testament, we come to Tertullian, of whom Lardner says, "that there are perhaps more and longer quotations of the small volume of the New Testament in this one Christian author, than of all the works of Cicero, though of so uncommon excellence for thought and style, in the writers of all characters for several ages."

The testimony of Christian writers vindicated,

39. We feel ourselves exposed in this part of our investigation, to the suspicion which adheres to every Christian testimony. We have already made some attempts to analyse that suspicion and its ingredients, and we conceive, that the circumstance of the Christians being an interested party, is only one, and not perhaps the principal of these ingredients. At all events, this may be the proper place for disposing of that one ingredient, and for offering a few general observations on the strength of the Christian testimony.

By the sufferings of the writers themselves,

40. In estimating the value of any testimony, there are two distinct subjects of consideration; the person who gives the testimony, and the people to whom the testimony is addressed. It is quite needless to enlarge on the resources which, in the present instance, we derive from both these considerations, and how much each of them contributes to the triumph and solidity of the Christian argument. In as far as the people who give the testimony are concerned, how could they be mistaken in their account of the books of the New Testament, when some of them lived in the same age with the original writers, and were their intimate acquaintances, and when all of them had the benefit of an uncontrolled series of evidence, reaching down from the date of the earliest publications to their own times? Or, how can we suspect that they falsified, when there runs through their writings the same tone of plainness and sincerity, which is allowed to stamp the character of authenticity on other productions; and, above all, when, upon the strength even of heathen testimony, we conclude, that many of them, by their sufferings and death, gave the highest evidence that man can give, of his speaking under the influence of a real and honest conviction?

By the concurrence of the Christian public,

In as far as the people who received the testimony are concerned, to what other circumstances can we ascribe their concurrence, but to the truth of that testimony? In what way was it possible to deceive them upon a point of general notoriety? The books of the New Testament are referred to by the ancient fathers, as writings generally known and respected by the Christians of that period. If they were obscure writings, or had no existence at the time, how can we account for the credit and authority of those fathers who appealed to them, and had the effrontery to insult their fellow Christians by a falsehood so palpable, and so easily detected? Allow them to be capable of this treachery, we have still to explain, how the people came to be the dupes of so glaring an imposition; how they could be permitted to give up every thing for a religion, whose teachers were so unprincipled as to deceive them, and so unwise as to commit themselves upon ground where it was impossible to elude discovery. Could Clement have dared to refer the people of Corinth to an epistle said to be received by themselves, and which had no existence? or, could he have referred the Christians at large to writings which they never heard of? And it was not enough to maintain the semblance of truth with the people of their own party. Where were the Jews all the time? and how was it possible to escape the correction of these keen and vigilant observers?

By the silence of enemies.

We mistake the matter much, if we think, that Christianity at that time was making its insidious way in silence and in secrecy, through a listless and unconcerned public. All history gives an opposite representation. The passions and curiosity of men were quite upon the alert. The popular enthusiasm had been excited on both sides of the question. It had drawn the attention of the established authorities in different provinces of the empire, and the merits of the Christian cause had become a matter of frequent and formal discussion in courts of judicature. If, in these circumstances, the Christian writers had the hardihood to venture upon a falsehood, it would have been upon safer ground than what they naturally adopted. They would never have hazarded to assert what was so open to contradiction, as the existence of books held in reverence among all the churches, and which yet nobody either in or out of these churches ever heard of. They would never have been so unwise as to commit in this way a cause, which had not a single circumstance to recommend it but its truth and its evidences.

41. The falsehood of the Christian testimony on this point, carries along with it a concurrence of circumstances, each of which is the strangest and most unprecedented that ever was heard of. First, That men, who sustained in their writings all the characters of sincerity, and many of whom submitted to martyrdom, as the highest pledge of sincerity which can possibly be given, should have been capable of falsehood at all. Second, That this tendency to falsehood should have been exercised so unwisely, as to appear in an assertion

perfectly open to detection, and which could be so readily converted to the discredit of that religion, which it was the favourite ambition of their lives to promote and establish in the world. Third, That this testimony could have gained the concurrence of the people to whom it was addressed, and that, with their eyes perfectly open to its falsehood, they should be ready to make the sacrifice of life and of fortune in supporting it. Fourth, That this testimony should never have been contradicted by the Jews, and that they should have neglected so effectual an opportunity of disgracing a religion, the progress of which they contemplated with so much jealousy and alarm. Add to this, that it is not the testimony of one writer, which we are making to pass through the ordeal of so many difficulties. It is the testimony of many writers, who lived at different times, and in different countries, and who add the very singular circumstance of their entire agreement with one another, to the other circumstances equally unaccountable, which we have just now enumerated. The falsehood of their united testimony is not to be conceived. It is a supposition which we are warranted to condemn, upon the strength of any one of the above improbabilities taken separately. But the fair way of estimating their effect upon the argument, is to take them jointly, and, in the language of the doctrine of chances, to take the product of all the improbabilities into one another. The argument which this product furnishes for the truth of the Christian testimony, has, in strength and conclusiveness, no parallel in the whole compass of ancient literature.

42. The testimony of Celsus is looked upon as peculiarly valuable, because it is disinterested. But if this consideration gives so much weight to the testimony of Celsus, why should so much doubt and suspicion annex to the testimony of Christian writers, several of whom, before his time, have given a fuller and more express testimony to the authenticity of the gospels? In the persecutions they sustained; in the obvious tone of sincerity and honesty which runs through their writings; in their general agreement upon this subject; in the multitude of their followers, who never could have confided in men that ventured to commit themselves, by the assertion of what was obviously and notoriously false; in the check which the vigilance, both of Jews and Heathens, exercised over every Christian writer of that period; in all these circumstances, they give every evidence of having delivered a fair and unpolluted testimony.

Internal marks of truth in the New Testament.

43. II. We shall now look into the New Testament itself, and endeavour to lay before the reader the internal marks of truth and honesty, which are to be found in it.

The minute accuracy of its allusion to existing manners.

44. Under this head, it may be right to insist upon the minute accuracy, which runs through all its allusions to the existing manners and circumstances of the times. To appreciate the force of this argument, it would be right to attend to the peculiar situation of Judea, at the time of our Saviour. It was then under the dominion of the Roman emperors, and comes frequently under the notice of the profane historians of that period. From this source we derive a great variety of information, as to the manner in which the emperors conducted the government of their different provinces; what degree of indulgence was allowed to the religious opinions of the people, whom they held in subjection; in how far they were suffered to live under the administration of their own laws; the power which was vested in the presidents of provinces; and a number of other circumstances relative to the criminal and civil jurisprudence of that period. In this way, there is a great number of different points in which the historians of the New Testament can be brought into comparison with the secular historians of the age. The history of Christ and his apostles contains innumerable references to the state of public affairs. It is not the history of obscure and unnoticed individuals. They had attracted much of the public attention. They had been before the governors of the country. They had passed through the established forms of justice; and some of them underwent the trial and punishment of the times. It is easy to perceive, then, that the New Testament writers were led to allude to a number of these circumstances in the political history and constitution of the times which came under the cognizance of ordinary historians. This was delicate ground for an inventor to tread upon; and particularly, if he lived at an age subsequent to the time of his history. He might in this case have fabricated a tale, by confining himself to the obscure and familiar incidents of private history; but it is only for a true and a cotemporary historian, to sustain a continued accuracy, through his minute and numerous allusions to the public policy and government of the times.

The extreme delicacy of this test.

45. Within the period of the gospel history, Judea experienced a good many vicissitudes in the state of its government. At one time it formed part of a kingdom under Herod the Great. At another, it formed part of a smaller government under Archelaus. It after this came under the direct administration of a Roman governor, which form was again interrupted for several years, by the elevation of Herod Agrippa to the sovereign power, as exercised by his grandfather; and it is at last left in the form of a province at the conclusion of the evangelical history. There were also frequent changes in the political state of the countries adjacent to Judea; and which are often alluded to in the New Testament. A caprice of the reigning emperor, often gave rise to a new form of government, and a new distribution of territory. It will be readily conceived, how much these perpetual fluctuations in the state of public affairs, both in Judea and its neighbourhood, must add to the power and difficulty of that ordeal to which the gospel history has been subjected.

The coincidence betwixt the writers of the New Testament and Jewish or profane authors.

46. On this part of the subject, there is no want of witnesses with whom to confront the writers of the New Testament. In addition to the Roman writers, who have touched upon the affairs of Judea, we have the benefit of a Jewish historian, who has given us a professed history of his own country. From him, as was to be expected, we have a far greater quantity of copious and detailed narrative, relative to the internal affairs of Judea, to the manners of the people, and those particulars which are connected with their religious belief, and ecclesiastical constitution. With many, it will be supposed to add to the value of his testimony, that he was not a Christian; but that, on the other hand, we have every reason to believe him to have been a most zealous and determined enemy to the cause. It is really a most useful exercise, to pursue the harmony which subsists betwixt the writers of the New Testament, and those Jewish and profane authors, with whom we bring them into comparison. Throughout the whole examination, our attention is confined to forms of justice; successions of governors in different provinces; manners, and political institutions. We are therefore apt to forget the sacredness of the subject; and we appeal to all who have prosecuted this enquiry, if this circumstance is not favourable to their having a closer and more decided impression of the truth of the gospel history. By instituting a comparison betwixt the evangelists and cotemporary authors, and restrict-

ing our attention to these points, which come under the cognizance of ordinary history, we put the apostles and evangelists on the footing of ordinary historians; and it is for those, who have actually undergone the labour of this examination, to tell how much this circumstance adds to the impression of their authenticity. The mind gets emancipated from the peculiar delusion, which attaches to the sacredness of the subject; and which has the undoubted effect of restraining the confidence of its enquiries. The argument assumes a secular complexion, and the writers of the New Testament are restored to that credit, with which the reader delivers himself up to any other historian, who has a much less weight and quantity of historical evidence in his favour.

47. It must be observed, that this opens up to us a field of enquiry, which is by far too extensive for the limits of the present article. We cannot even so much as enter into it, and must restrict ourselves to a few general observations on the nature and precise effect of the argument.

This a strong argument of the antiquity of the writers.

48. In the first place, the accuracy of the numerous allusions to the circumstances of that period, which the gospel history embraces, forms a strong corroboration of that antiquity, which we have already assigned to its writers from external testimony. It amounts to a proof, that it is the production of authors, who lived antecedent to the destruction of Jerusalem, and consequently about the time that is ascribed to them by all the external testimony, which has already been insisted upon. It is that accuracy, which could only be maintained by a cotemporary historian. It would be difficult, even for the author of some general speculation, not to betray his time by some occasional allusion to the ephemeral customs and institutions of the period in which he wrote. But the authors of the New Testament run a much greater risk. There are five different pieces of that collection, which are purely historical, and where there is a continued reference to the characters, and politics, and passing events of the day. The destruction of Jerusalem swept away the whole fabric of Jewish polity, and it is not to be conceived, that the memory of a future generation, could have retained that minute, that varied, that intimate acquaintance with the statistics of a nation no longer in existence, which is evinced in every page of the evangelical writers. We find, in point of fact, that both the Heathen and Christian writers of subsequent ages do often betray their ignorance of the particular customs which obtained in Judea, during the time of our Saviour. And it must be esteemed a strong circumstance in favour of the antiquity of the New Testament, that on a subject, in which the chances of detection are so numerous, and where we can scarcely advance a single step in the narrative without the possibility of betraying our time by some mistaken allusion, it stands distinguished from every later composition in being able to bear the most minute and intimate comparison with the cotemporary historians of that period.

49. The argument derives great additional strength, from viewing the New Testament, not as one single performance, but as a collection of several performances. It is the work of no less than eight different authors, who wrote without any appearance of concert, who published in different parts of the world, and whose writings possess every evidence, both internal and external, of being independent productions. Had only one author exhibited the same minute accuracy of allusion, it would have been esteemed a very strong evidence of his antiquity. But when we see so many authors, exhibiting such a well sustained and almost unexcepted accuracy, through the whole of their varied and distinct narratives; it seems difficult to avoid the conclusion, that they were either the eye-witnesses of their own history, or lived about the period of its accomplishment.

50. When different historians undertake the affairs of the same period, they either derive their information from one another, or proceed upon distinct and independent information of their own. Now, it is not difficult to distinguish the copyist from the original historian. There is something in the very style and manner of an original narrative, which announces its pretensions. It is not possible that any one event, or any series of events, should make such a similar impression upon two witnesses, or dispose them to relate it in the same language, to describe it in the same order, to form the same estimate, as to the circumstances which should be noticed as important, and those other circumstances which should be suppressed as immaterial. Each witness tells the thing in his own way, makes use of his own language, and brings forward circumstances, which the other might omit altogether, as not essential to the purpose of his narrative. It is this agreement in the facts, with this variety in the manner of describing them, that never fails to impress upon the enquirer that additional conviction, which arises from the concurrence of separate and independent testimonies. Now this is precisely that kind of coincidence, which subsists betwixt the New Testament writers and Josephus, in their allusions to the peculiar customs and institutions of that age. Each party maintains the style of original and independent historians. The one often omits altogether, or makes only a slight and distant allusion to what occupies a prominent part in the composition of the other. There is not the slightest vestige of any thing like a studied coincidence betwixt them. There is variety, but no opposition; and it says much for the authenticity of both histories, that the most scrupulous and attentive criticism, can scarcely detect a single example of an apparent contradiction in the testimony of these different authors, which does not admit of a likely, or at least a plausible, reconciliation.

Their substantial, but at the same time unstudied agreement with Josephus.

51. When the difference betwixt two historians is carried to the length of a contradiction, it enfeebles the credit of both their testimonies. When the agreement is carried to the length of a close and scrupulous resemblance in every particular, it destroys the credit of one of the parties, as an independent historian. In the case before us, we neither perceive this difference, nor this agreement. Such are the variations, that, at first sight, the reader is alarmed with the appearance of very serious and embarrassing difficulties. And such is the actual coincidence, that the difficulties vanish, when we apply to them the labours of a profound and intelligent criticism. Had it been the object of the gospel writers to trick out a plausible imposition on the credulity of the world, they would have studied a closer resemblance to the existing authorities of that period; nor would they have laid themselves open to the superficial brilliancy of Voltaire, which dazzles every imagination, and reposed their vindication with the Lelands and Lardners of a distant posterity, whose sober erudition is so little attended to, and which so few know how to appretiate.

Example of an apparent discrepancy.

52. In the gospel, we are told that Herod, the Tetrach of Galilee, married his brother Philip's wife. In Josephus, we have the same story; only he gives a different name to Philip, and calls him Herod; and what adds to the difficulty, there was a Philip of that family, whom we knew not to have been the first husband of Herodias. This is at first sight a little alarming. But, in the progress of our inquiries, we are given to under-

stand from this same Josephus, that there were three Herods in the same family; and therefore, no improbability in there being two Philips. We also know from the histories of that period, that it was quite common for the same individual to have two names; and this is never more necessary, than when employed to distinguish brothers who have one name the same. The Herod who is called Philip, is just as likely a distinction, as the Simon who is called Peter, or the Saul who is called Paul. The name of the high-priest, at the time of our Saviour's crucifixion, was Caiaphas, according to the evangelists. According to Josephus, the name of the high-priest at that period was Joseph. This would have been precisely a difficulty of the same kind, had not Josephus happened to mention, that this Joseph was also called Caiaphas. Would it have been dealing fairly with the evangelists, we ask, to have made their credibility depend upon the accidental omission of another historian? Is it consistent with any acknowledged principle of sound criticism, to bring four writers so entirely under the tribunal of Josephus, each of whom stands as firmly supported by all the evidences which can give authority to an historian; and have greatly the advantage of him in this, that they can add the argument of their concurrence to the argument of each separate and independent testimony? It so happens, however, in the present instance, that even Jewish writers, in their narrative of the same circumstance, give the name of Philip to the first husband of Herodias. We by no means conceive, that any foreign testimony was necessary for the vindication of the evangelists. Still, however, it must go far to dissipate every suspicion of artifice in the construction of their histories. It proved, that, in the confidence with which they delivered themselves up to their own information, they neglected appearance, and felt themselves independent of it. This apparent difficulty, like many others of the same kind, lands us in a stronger confirmation of the honesty of the evangelists; and it is delightful to perceive, how truth receives a fuller accession to its splendour, from the attempts which are made to disgrace and to darken it.

53. On this branch of the argument, the impartial inquirer must be struck with the little indulgence which infidels, and even Christians, have given to the evangelical writers. In other cases, when we compare the narratives of cotemporary historians, it is not expected, that all the circumstances alluded to by one will be taken notice of by the rest; and it often happens, that an event or a custom is admitted upon the faith of a single historian; and the silence of all other writers is not suffered to attach suspicion or discredit to his testimony. It is an allowed principle, that a scrupulous resemblance betwixt two histories is very far from necessary to their being held consistent with one another. And what is more, it sometimes happens, that with cotemporary historians, there may be an apparent contradiction, and the credit of both parties remain as entire and unsuspicious as before. Posterity is in these cases disposed to make the most liberal allowances. Instead of calling it a contradiction, they often call it a difficulty. They are sensible, that, in many instances, a seeming variety of statements has, upon a more extensive knowledge of ancient history, admitted of a perfect reconciliation. Instead, then, of referring the difficulty in question to the inaccuracy or bad faith of any of the parties, they, with more justness and more modesty, refer it to their own ignorance, and to that obscurity which necessarily hangs over the history of every remote age. These principles are suffered to have great influence in every similar investigation; but so soon as, instead of a similar, it becomes a sacred investigation, every ordinary principle is abandoned, and the suspicion annexed to the teachers of religion is carried to the dereliction of all that candour and liberality with which every other document of antiquity is judged of and appreciated. How does it happen, that the authority of Josephus should be acquiesced in as a first principle, while every step, in the narrative of the evangelists, must have foreign testimony to confirm and support it? How comes it, that the silence of Josephus should be construed into an impeachment of the testimony of the evangelists, while it is never admitted for a single moment, that the silence of the evangelists can impart the slightest blemish to the testimony of Josephus? How comes it, that the supposition of two Philips in one family should throw a damp of scepticism over the gospel narrative, while the only circumstance which renders that supposition necessary is the single testimony of Josephus; in which very testimony it is necessarily implied, that there are two Herods in that same family? How comes it, that the evangelists, with as much internal, and a vast deal more of external evidence in their favour, should be made to stand before Josephus, like so many prisoners at the bar of justice? In any other case, we are convinced, that this would be looked upon as *rough handling*. But we are not sorry for it. It has given more triumph and confidence to the argument. And it is no small addition to our faith, that its first teachers have survived an examination, which, in point of rigour and severity, we believe to be quite unexampled in the annals of criticism.

The circumstantiality of the gospel narrative forms another internal evidence in its favour.

54. It is always looked upon as a favourable presumption, when a story is told circumstantially. The art and the safety of an impostor is to confine his narrative to generals, and not to commit himself by too minute a specification of time and place, and allusion to the manners or occurrences of the day. The more of circumstance that we introduce into a story, we multiply the chances of detection, if false; and therefore, where a great deal of circumstance is introduced, it proves, that the narrator feels the confidence of truth, and labours under no apprehension for the fate of his narrative. Even though we have it not in our power to verify the truth of a single circumstance, yet the mere property of a story being circumstantial is always felt to carry an evidence in its favour. It imparts a more familiar air of life and reality to the narrative. It is easy to believe, that the groundwork of a story may be a fabrication; but it requires a more refined species of imposture than we can well conceive, to construct a harmonious and well sustained narrative, abounding in minute and circumstantial details which support one another, and where, with all our experience of real life, we can detect nothing misplaced, or inconsistent, or improbable.

In the first age of Christianity, this circumstance could be verified by immediate observation;

55. To prosecute this argument in all its extent, it would be necessary to present the reader with a complete analysis or examination of the gospel history. But the most superficial observer cannot fail to perceive, that it maintains, in a very high degree, the character of being a circumstantial narrative. When a miracle is recorded, we have generally the name of the town or neighbourhood where it happened; the names of the people concerned; the effect upon the hearts, and convictions of the bye-standers; the arguments and examinations it gave birth to; and all that minuteness of reference and description which impresses a strong character of reality upon the whole history. If we take along with us the time at which this history made its appearance, the argument becomes much stronger. It does not merely carry

a presumption in its favour, from being a circumstantial history: It carries a proof in its favour, because these circumstances were completely within the reach and examination of those to whom it was addressed. Had the evangelists been false historians, they would not have committed themselves upon so many particulars. They would not have furnished the vigilant inquirers of that period with such an effectual instrument for bringing them into discredit with the people; nor foolishly supplied, in every page of their narrative, so many materials for a cross-examination, which would infallibly have disgraced them.

And in the present age, by comparison with cotemporary authors.

Examples.

56. Now, we of this age can institute the same cross-examination. We can compare the evangelical writers with cotemporary authors, and verify a number of circumstances in the history, and government, and peculiar economy of the Jewish people. We therefore have it in our power to institute a cross-examination upon the writers of the New Testament; and the freedom and frequency of their allusions to these circumstances supply us with ample materials for it. The fact, that they are borne out in their minute and incidental allusions by the testimony of other historians, gives a strong weight of what has been called circumstantial evidence in their favour. As a specimen of the argument, let us confine our observations to the history of our Saviour's trial, and execution, and burial. They brought him to Pontius Pilate. We know both from Tacitus and Josephus, that he was at that time governor of Judea. A sentence from him was necessary, before they could proceed to the execution of Jesus; and we know that the power of life and death was usually vested in the Roman governor. Our Saviour was treated with derision; and this we know to have been a customary practice at that time, previous to the execution of criminals, and during the time of it. Pilate scourged Jesus, before he gave him up to be crucified. We know from ancient authors, that this was a very usual practice among the Romans. The account of an execution generally run in this form:—He was stripped, whipped, and beheaded or executed. According to the evangelists, his accusation was written on the top of the cross; and we learn from Suetonius and others, that the crime of the person to be executed was affixed to the instrument of his punishment. According to the evangelists, this accusation was written in three different languages; and we know from Josephus, that it was quite common in Jerusalem to have all public advertisements written in this manner. According to the evangelists, Jesus had to bear his cross; and we know from other sources of information, that this was the constant practice of these times. According to the evangelists, the body of Jesus was given up to be buried at the request of friends. We know that, unless the criminal was infamous, this was the law, or the custom with all Roman governors.

The artless manner in which the circumstances are introduced.

57. These, and a few more particulars of the same kind, occur within the compass of a single page of the evangelical history. The circumstantial manner of the history affords a presumption in its favour, antecedent to all examination into the truth of the circumstances themselves. But it makes a strong addition to the evidence, when we find, that in all the subordinate parts of the main story, the evangelists maintain so great a consistency, with the testimony of other authors, and with all that we can collect from other sources of information, as to the manners and institutions of that period. It is difficult to conceive, in the first instance, how the inventor of a fabricated story would hazard such a number of circumstances, each of them supplying a point of comparison with other authors, and giving to the enquirer an additional chance of detecting the imposition. And it is still more difficult to believe, that truth should have been so artfully blended with falsehood in the composition of this narrative, particularly as we perceive nothing like a forced introduction of any one circumstance. There appears to be nothing out of place, nothing thrust in with the view of imparting an air of probability to the history. The circumstance upon which we bring the evangelists into comparison with profane authors, is often not intimated in a direct form, but in the form of a slight or distant allusion. There is not the most remote appearance of its being fetched or sought for. It is brought in accidentally, and flows in the most natural and undesigned manner out of the progress of the narrative.

The consistency of the gospel narrative.

58. The circumstance, that none of the gospel-writers are inconsistent with one another, falls better under a different branch of the argument. It is enough for our present purpose, that there is no single writer inconsistent with himself. It often happens, that falsehood carries its own refutation along with it; and that, through the artful disguises which are employed in the construction of a fabricated story, we can often detect a flaw or a contradiction, which condemns the authority of the whole narrative. Now, every single piece of the New Testament, wants this mark or character of falsehood. The different parts are found to sustain, and harmonise, and flow out of each other. Each has at least the merit of being a consistent narrative. For any thing we see upon the face of it, it may be true, and a further hearing must be given before we can be justified in rejecting it as the tale of an impostor.

The simple and unostentatious manner of the evangelists.

Their confidence in the integrity of their narrative.

59. There is another mark of falsehood, which each of the gospel narratives appears to be exempted from. There is little or no parading about their own integrity. We can collect their pretensions to credit from the history itself, but we see no anxious display of these pretensions. We cannot fail to perceive the force of that argument, which is derived from the publicity of the Christian miracles, and the very minute and scrupulous examination, which they had to sustain from the rulers, and official men of Judea. But this publicity, and these examinations, are simply recorded by the evangelists. There is no boastful reference to these circumstances, and no ostentatious display of the advantage which they give to the Christian argument. They bring their story forward in the shape of a direct and unencumbered narrative, and deliver themselves with that simplicity and unembarrassed confidence, which nothing but their consciousness of truth and the perfect feeling of their own strength and consistency can account for. They do not write, as if their object was to carry a point that was at all doubtful or suspicious. It is simply to transmit to the men of other times, and of other countries, a memorial of the events which led to the establishment of the Christian religion in the world. In the prosecution of their narrative, we challenge the most refined judge of the human character, to point out a single symptom of diffidence, in the truth of their own story, or of art to cloak this diffidence from the notice of the most severe and vigilant observers. The manner of the New Testament writers does not carry in it the slightest idea of its being a put on manner. It is quite natural, quite unguarded, and free of all apprehension that their story is to meet with any discredit or contradiction from any of those numerous readers, who had it fully in their power to verify or to expose it. We see no expedient made use of to obtain or to conciliate the acquiescence of their readers. They appear to feel as if they did not need it. They deliver what they have to say in a round and un-

varnished manner; nor is it in general accompanied with any of those strong asseverations, by which an impostor so often attempts to practise upon the credulity of his victims.

They betray no apprehension of wonder or incredibility on the part of their readers.

60. In the simple narrative of the evangelists, they betray no feeling of wonder at the extraordinary nature of the events which they record, and no consciousness that what they are announcing is to excite any wonder among their readers. This appears to us, to be a very strong circumstance. Had it been the newly broached tale of an impostor, he would, in all likelihood, have feigned astonishment himself, or at least have laid his account with the doubt and astonishment of those to whom it was addressed. When a person tells a wonderful story to a company who are totally unacquainted with it, he must be sensible, not merely of the surprise which is excited in the minds of the hearers, but of a corresponding sympathy in his own mind with the feelings of those who listen to him. He lays his account with the wonder, if not the incredulity, of his hearers; and this distinctly appears in the terms with which he delivers his story, and the manner in which he introduces it. It makes a wide difference, if, on the other hand, he tells the same story to a company, who have long been apprised of the chief circumstances, but who listen to him for the mere purpose of obtaining a more distinct and particular narrative. Now, in as far as we can collect from the manner of the evangelists, they stand in this last predicament. They do not write, as if they were imposing a novelty upon their readers. In the language of Luke, they write for the sake of giving more distinct information; and that the readers *might know the certainty of those things, wherein they had been instructed.* In the prosecution of this task, they deliver themselves with the most familiar and unembarrassed simplicity. They do not appear to anticipate the surprise of their readers, or to be at all aware, that the marvellous nature of their story is to be any obstacle to its credit or reception in the neighbourhood. At the first performance of our Saviour's miracles, there was a strong and a widely spread sensation over the whole country. *His fame went abroad*, and *all people were amazed.* This is quite natural; and the circumstance of no surprise being either felt or anticipated by the evangelists, in the writing of their history, can best be accounted for by the truth of the history itself, that the experience of years had blunted the edge of novelty, and rendered miracles familiar, not only to them, but to all the people to whom they addressed themselves.

The unity of mind ascribed to JesusChrist.

61. What appears to us a most striking internal evidence for the truth of the gospel, is that perfect unity of mind and of purpose which is ascribed to our Saviour. Had he been an impostor, he could not have foreseen all the fluctuations of his history, and yet no expression of surprise is recorded to have escaped from him. No event appears to have caught him unprepared. We see no shifting of doctrine or sentiment, with a view to accommodate to new or unexpected circumstances. His parables and warnings to his disciples, give sufficient intimation, that he laid his account with all those events, which appeared to his unenlightened friends to be so untoward, and so promising. In every explanation of his objects, we see the perfect consistency of a mind, before whose prophetic eye, all futurity lay open; and when the events of this futurity came round, he met them, not as chances, that were unforeseen, but as certainties which he had provided for. This consistency of his views is supported through all the variations of his history, and it stands finally contrasted in the record of the evangelists, with the misconceptions, the surprises, the disappointments of his followers. The gradual progress of their minds from the splendid anticipations of earthly grandeur, to a full acquiescence in the doctrine of a crucified Saviour, throws a stronger light on the perfect unity of purpose and of conception which animated his, and which can only be accounted for by the inspiration that filled and enlightened it. It may have been possible enough to describe a self-sustained example of this contrast from an actual history before us. It is difficult, however, to conceive, how it could be sustained so well, and in a manner so apparently artless, by means of invention, and particularly when the inventors made their own errors and their own ignorance form part of the fabrication.

The credibility of the first testimonies of the gospel history.

62. III. There was nothing in the situation of the New Testament writers, which leads us to perceive that they had any possible inducement for publishing a falsehood.

The persecution to which the first witnesses were exposed.

63. We have not to allege the mere testimony of the Christian writers, for the danger to which the profession of Christianity exposed all its adherents at that period. We have the testimony of Tacitus to this effect. We have innumerable allusions, or express intimations of the same circumstance in the Roman historians. The treatment and persecution of the Christians makes a principal figure in the affairs of the empire; and there is no point better established in antient history, than that the bare circumstance of being a Christian, brought many to the punishment of death, and exposed all to the danger of a suffering, the most appalling and repulsive to the feelings of our nature.

64. It is not difficult to perceive, why the Roman government, in its treatment of Christians, departed from its usual principles of toleration. We know it to have been their uniform practice, to allow every indulgence to the religious belief of those different countries, in which they established themselves. The truth is, that such an indulgence demanded of them no exertion of moderation or principle. It was quite consonant to the spirit of Paganism. A different country worshipped different gods, but it was a general principle of Paganism, that each country had its gods, to which the inhabitants of that country owed their peculiar homage and veneration. In this way there was no interference betwixt the different religions which prevailed in the world. It fell in with the policy of the Roman government to allow the fullest toleration to other religions, and it demanded no sacrifice of principle. It was even a dictate of principle with them to respect the gods of other countries and the violation of a religion different from their own, seems to have been felt, not merely as a departure from policy or justice, but to be viewed with the same sentiment of horror, which is annexed to blasphemy or sacrilege. So long as we are under Paganism, the truth of one religion does not involve in it the falsehood or rejection of another. In respecting the religion of another country, we did not abandon our own; nor did it follow, that the inhabitants of that other country, annexed any contempt or discredit to the religion in which we had been educated. In this mutual reverence for the religion of each other, no principle was departed from, and no object of veneration abandoned. It did not involve in it the denial, or relinquishment of their own gods, but only the addition of so many more gods to their catalogue.

65. In this respect, however, the Jews stood distinguished from every other people within the limits of the Roman empire. Their religious belief carried in it something more than attachment to their own system. It carried in it the contempt and detestation of every other. Yet, in spite of this circumstance, their religion was protected

by the mild and equitable toleration of the Roman government. The truth is, that there was nothing in the habits or character of the Jews, which was calculated to give much disturbance to the establishments of other countries. Though they admitted converts from other nations, yet their spirit of proselytism was far from being of that active or adventurous kind, which could alarm the Roman government for the safety of any existing institutions. Their high and exclusive veneration for their own system, gave an universal disdain to the Jewish character, which was not at all inviting to foreigners; but still, as it led to nothing mischievous in point of effect, it seems to have been overlooked by the Roman government, as a piece of impotent vanity.

66. But the case was widely different with the Christian system. It did not confine itself to the denial or rejection of every other system. It was for imposing its own exclusive authority over the consciences of all, and for detaching as many as it could from their allegiance to the religion of their own country. It carried on its forehead all the offensive characters of a monopoly, and not merely excited resentment by the supposed arrogance of its pretensions, but from the rapidity and extent of its innovations, spread an alarm over the whole Roman empire for the security of all its establishments. Accordingly, at the commencement of its progress, so long as it was confined to Judea, and the immediate neighbourhood, it seems to have been in perfect safety from the persecutions of the Roman government. It was at first looked upon as a mere modification of Judaism, and that the first Christians differed from the rest of their countrymen, only *in certain questions of their own superstition.* For a few years, after the crucifixion of our Saviour, it seems to have excited no alarm on the part of the Roman emperors, who did not depart from their usual maxims of toleration, till they began to understand the magnitude of its pretensions, and the unlooked for success which attended them.

67. In the course of a very few years, after its first promulgation, it drew down upon it the hostility of the Roman government; and the fact is undoubted, that some of its first teachers, who announced themselves to be the companions of our Saviour, and the eye-winesses of all the remarkable events in his history, suffered martyrdom for their adherence to the religion which they taught.

68. The disposition of the Jews to the religion of Jesus was no less hostile; and it manifested itself at a still earlier stage of the business. The causes of this hostility are obvious to all, who are in the slightest degree conversant with the history of those times. It is true that the Jews did not at all times possess the power of life and death, nor was it competent for them to bring the Christians to execution by the exercise of legal authority. Still, however, their powers of mischief were considerable. Their wishes had always a certain controul over the measures of the Roman governor; and we know, that it was this controul, which was the means of extorting from Pilate the unrighteous sentence by which the very first teacher of our religion was brought to a cruel and ignominious death. We also know, that under Herod Agrippa, the power of life and death was vested in a Jewish sovereign, and that this power was actually exerted against the most distinguished Christians of that time. Add to this, that the Jews had, at all times, the power of inflicting the lesser punishments. They could whip, they could imprison. Besides all this, the Christians had to brave the frenzy of an enraged multitude; and some of them actually suffered martyrdom in the violence of the popular commotions.

69. Nothing is more evident than the utter disgrace which was annexed by the world at large to the profession of Christianity at that period. Tacitus calls it "*superstitio exitiabilis,*" and accuses the Christians of enmity to mankind. By Epictetus and others, their heroism is termed obstinacy, and it was generally treated by the Roman governors as the infatuation of a miserable and despised people. There was none of that glory annexed to it which blazes around the martyrdom of a patriot or a philosopher. That constancy, which, in another cause, would have made them illustrious, was held to be a contemptible folly, which only exposed them to the derision and insolence of the multitude. A name and a reputation in the world might sustain the dying moments of Socrates or Regulus, but what earthly principles can account for the intrepidity of those poor and miserable outcasts, who consigned themselves to a voluntary martyrdom in the cause of their religion?

70. Having premised these observations, we offer the following alternative to the mind of every candid enquirer. The first Christians either delivered a sincere testimony, or they imposed a story upon the world which they knew to be a fabrication.

71. The persecutions to which the first Christians voluntarily exposed themselves, compel us to adopt the first part of the alternative. It is not to be conceived, that a man would resign fortune, and character, and life, in the assertion of what he knew to be a falsehood. The first Christians must have believed their story to be true; and it only remains to prove, that if they believed it to be true, it must be true indeed.

They prove the sincerity of the first witnesses,

72. A voluntary martyrdom must be looked upon as the highest possible evidence which it is in the power of man to give of his sincerity. The martyrdom of Socrates has never been questioned, as an undeniable proof of the sincere devotion of his mind to the principles of that philosophy for which he suffered. The death of Archbishop Cranmer will be allowed by all, to be a decisive evidence of his sincere rejection of what he conceived to be the errors of Popery, and his thorough conviction in the truth of the opposite system. When the council of Geneva burnt Servetus, no one will question the sincerity of the latter's belief, however much he may question the truth of it. Now, in all these cases, the proof goes no further, than to establish the sincerity of the martyr's belief. It goes but a little way indeed, in establishing the justness of it. This is a different question. A man may be mistaken, though he is sincere. His errors, if they are not seen to be such, will exercise all the influence and authority of truth over him. Martyrs have bled on the opposite sides of the question. It is impossible, then, to rest on this circumstance, as an argument for the truth of either system, but the argument is always deemed incontrovertible, in as far as it goes to establish the sincerity of each of the parties, and that both died in the firm conviction of the doctrines which they professed.

And the truth of their testimony.

73. Now the martyrdom of the first Christians, stands distinguished from all other examples by this circumstance, that it not merely proves the sincerity of the martyr's belief; but it also proves, that what he believed was true. In other cases of martyrdom, the sufferer, when he lays down his life, gives his testimony to the truth of an opinion. In the case of the Christians, when they laid down their lives, they gave their testimony to the truth of a fact, of which they affirmed themselves to be the eye and the ear witnesses. The sincerity of both

testimonies is unquestionable; but it is only in the latter case, that the truth of the testimony follows as a necessary consequence of its sincerity. An opinion comes under the cognizance of the understanding, ever liable, as we all know, to error and delusion. A fact comes under the cognizance of the senses, which have ever been esteemed as infallible, when they give their testimony to such plain, and obvious, and palpable appearances, as those which make up the evangelical story. We are still at liberty to question the philosophy of Socrates, or the orthodoxy of Cranmer and Servetus; but if we were told by a Christian teacher, in the solemnity of his dying hour, and with the dreadful apparatus of martyrdom before him, that he saw Jesus after he had risen from the dead; that he conversed with him many days; that he put his hand into the print of his sides; and, in the ardour of his joyful conviction, exclaimed, "My Lord, and my God!" we should feel that there was no truth in the world, if this language and this testimony could deceive us.

74. If Christianity be not true, then the first Christians must have been mistaken as to the subject of their testimony. This supposition is destroyed by the nature of the subject. It was not testimony to a doctrine which might deceive the understanding. It was something more than testimony to a dream, or a trance, or a midnight fancy, which might deceive the imagination. It was testimony to a multitude, and a succession of palpable facts, which could never have deceived the senses, and which preclude all possibility of mistake, even though it had been the testimony only of one individual. But when in addition to this we consider, that it is the testimony, not of one, but of many individuals; that it is a story repeated in a variety of forms, but substantially the same; that it is the concurring testimony of different eye-witnesses, or the companions of eye-witnesses—we may, after this, take refuge in the idea of falsehood and collusion, but it is not to be admitted, that those eight different writers of the New Testament, could have all blundered the matter with such method, and such uniformity.

75. We know that, in spite of the magnitude of their sufferings, there are infidels who, driven from the second part of the alternative, have recurred to the first, and have affirmed, that the glory of establishing a new religion, induced the first Christians to assert, and to persist in asserting, what they knew to be a falsehood. But (though we should be anticipating the last branch of the argument) they forget, that we have the concurrence of two parties to the truth of Christianity, and that it is the conduct only of one of the parties, which can be accounted for by the supposition in question. The two parties are the teachers and the taught. The former may aspire to the glory of founding a new faith; but what glory did the latter propose to themselves from being the dupes of an imposition so ruinous to every earthly interest, and held in such low and disgraceful estimation by the world at large? Abandon the teachers of Christianity to every imputation, which infidelity, on the rack for conjectures to give plausibility to its system, can desire; how shall we explain the concurrence of its disciples? There may be a glory in leading, but we see no glory in being led. If Christianity were false, and Paul had the effrontery to appeal to his 500 living witnesses whom he alleges to have seen Christ after his resurrection; the submissive acquiescence of his disciples remains a very inexplicable circumstance. The same Paul, in his epistles to the Corinthians, tells them that some of them had the gift of healing, and the power of working miracles; and that the sign of an apostle had been wrought among them in wonders and mighty deeds. A man aspiring to the glory of an accredited teacher, would never have committed himself on a subject, where his falsehood could have been so readily exposed. And in the veneration with which we know his epistles to have been preserved by the church of Corinth, we have not merely the testimony of their writer to the truth of the Christian miracles, but the testimony of a whole people who had no interest in being deceived.

76. Had Christianity been false, the reputation of its first teachers lay at the mercy of every individual among the numerous proselytes which they had gained to their system. It may not be competent for an unlettered peasant to detect the absurdity of a doctrine; but he can at all times lift his testimony against a fact, said to have happened in his presence, and under the observation of his senses. Now it so happens, that in a number of the epistles, there are allusions or express intimations of the miracles that had been wrought in the different churches to which these epistles are addressed. How comes it, if it be all a fabrication, that it was never exposed? We know that some of the disciples were driven by the terrors of persecuting violence to resign their profession. How should it happen, that none of them ever attempted to vindicate their apostacy, by laying open the artifice and insincerity of their Christian teachers? We may be sure that such a testimony would have been highly acceptable to the existing authorities of that period. The Jews would have made the most of it; and the vigilant and discerning officers of the Roman government would not have failed to turn it to account. The mystery would have been exposed and laid open, and the curiosity of latter ages would have been satisfied as to the wonderful and unaccountable steps, by which a religion could make such head in the world, though it rested its whole authority on facts; the falsehood of which was accessible to all who were at the trouble to enquire about them. But no! We hear of no such testimony from the apostates of that period. We read of some, who, agonised at the reflection of their treachery, returned to their first profession, and expiated, by martyrdom, the guilt which they felt they had incurred by their dereliction of the truth. This furnishes a strong example of the power of conviction, and when we join with it, that it is conviction in the integrity of those teachers who appealed to miracles which had been wrought among them, it appears to us a testimony in favour of our religion which is altogether irresistible.

The credibility of the subsequent testimonies to the gospel history.

77. IV. But this brings us to the last division of the argument, viz. that the leading facts in the history of the gospel are corroborated by the testimony of others.

The implied testimony of the first converts.

78. The evidence we have already brought forward for the antiquity of the New Testament, and the veneration in which it was held from the earliest ages of the church, is an implied testimony of all Christians to the truth of the gospel history. By proving the authenticity of St Paul's epistles to the Corinthians, we not merely establish his testimony to the truth of the Christian miracles; we establish the additional testimony of the whole church of Corinth, who would never have respected these epistles, if Paul had ventured upon a falsehood so open to detection, as the assertion, that miracles were wrought among them, which not a single individual ever witnessed. By proving the authenticity of the New Testament at large, we secure, not merely that argument which is founded on the testimony and concurrence of those immense multitudes, who in distant countries submitted to the New Testament as the rule of their faith. The tes-

timony of the teachers, whether we take into consideration the subject of that testimony, or the circumstances under which it was delivered, is of itself a stronger argument for the truth of the gospel history than can be alleged for the truth of any other history which has been transmitted down to us from ancient times. The concurrence of the taught carries along with it a host of additional testimonies, which gives an evidence to the evangelical story, that is altogether unexampled. On a point of ordinary history, the testimony of Tacitus is held decisive, because it is not contradicted. The history of the New Testament is not only not contradicted, but confirmed by the strongest possible expressions which men can give of their acquiescence in its truth; by thousands who were either agents or eye-witnesses of the transactions recorded, who could not be deceived, who had no interest, and no glory to gain by supporting a falsehood, and who, by their sufferings in the cause of what they professed to be their belief, gave the highest evidence, that human nature can give of sincerity.

79. In this circumstance, it may be perceived, how much the evidence for Christianity goes beyond all ordinary historical evidence. A profane historian relates a series of events which happen in a particular age; and we count it well, if it be his own age, and if the history which he gives us be the testimony of a cotemporary author. Another historian succeeds him at the distance of years, and by repeating the same story, gives additional evidence of his testimony to its truth. A third historian perhaps goes over the same ground, and lends another confirmation to the history. And it is thus, by collecting all the lights which are thinly scattered over the tract of ages and of centuries, that we obtain all the evidence which can be got, and all the evidence that is generally wished for.

80. Now, there is room for a thousand presumptions, which, if admitted, would overturn the whole of this evidence. For any thing we know, the first historians may have had some interest in disguising the truth, or substituting in its place a falsehood, and a fabrication. True, it has not been contradicted, but they form a very small number of men who feel strongly or particularly interested in a question of history. The literary and speculative men of that age may have perhaps been engaged in other pursuits, or their testimonies may have perished in the wreck of centuries. The second historian may have been so far removed in point of time from the events of his narratives, that he can furnish us not with an independent, but with a derived testimony. He may have copied his account from the original historian, and the falsehood have come down to us in the shape of an authentic and well attested history. Presumptions may be multiplied without end, yet in spite of them, there is a natural confidence in the veracity of man, which disposes us to as firm a belief in many of the facts of antient history, as in the occurrences of the present day.

81. The history of the gospel, however, stands distinguished from all other history, by the uninterrupted nature of its testimony, which carries down its evidence, without a chasm, from its earliest promulgation to the present day. We do not speak of the superior weight and splendour of its evidences, at the first publication of that history, as being supported, not merely by the testimony of one, but by the concurrence of several independent witnesses. We do not speak of its subsequent writers, who, follow one another in a far closer and more crowded train, than there is any other example of in the history or literature of the world. We speak of the strong though unwritten testimony of its numerous proselytes, who, in the very fact of their proselytism, give the strongest possible confirmation to the gospel, and fill up every chasm in the recorded evidence of past times.

The express testimony of subsequent writers.

82. In the written testimonies for the truth of the Christian religion, Barnabas comes next in order to the first promulgators of the evangelical story. He was a cotemporary of the apostles, and writes a very few years after the publication of the pieces which make up the New Testament. Clement follows, who was a fellow labourer of Paul, and writes an epistle in the name of the church of Rome, to the church of Corinth. The written testimonies follow one another with a closeness and a rapidity of which there is no example; but what we insist on at present, is the unwritten and implied testimony of the people who composed these two churches. There can be no fact better established, than that these two churches were planted in the days of the apostles, and that the epistles which were respectively addressed to them, were held in the utmost authority and veneration. There is no doubt, that the leading facts of the gospel history were familiar to them; that it was in the power of many individuals amongst them to verify these facts, either by their own personal observation, or by an actual conversation with eye-witnesses; and that in particular, it was in the power of almost every individual in the church of Corinth, either to verify the miracles which St Paul alludes to, in his epistle to that church, or to detect and expose the imposition, had there been no foundation for such an allusion. What do we see in all this, but the strongest possible testimony of a whole people to the truth of the Christian miracles: there is nothing like this in common history, the formation of a society, which can only be explained by the history of the gospel, and where the conduct of every individual furnishes a distinct pledge and evidence of its truth. And to have a full view of the argument, we must reflect, that it is not one, but many societies scattered over the different countries of the world; that the principle upon which each society was formed, was the divine authority of Christ and his apostles, resting upon the recorded miracles of the New Testament; that these miracles were wrought with a publicity, and at a nearness of time, which rendered them accessible to the enquiries of all, for upwards of half a century; that nothing but the power of conviction could have induced the people of that age to embrace a religion so disgraced and so persecuted; that every temptation was held out for its disciples to abandon it; and that though some of them, overpowered by the terrors of punishment, were driven to apostacy, yet not one of them has left us a testimony which can impeach the miracles of Christianity, or the integrity of its first teachers.

83. It may be observed, that in pursuing the line of continuity from the days of the apostles, the written testimonies for the truth of the Christian miracles follow one another in closer succession, than we have any other example of in antient history. But what gives such peculiar and unprecedented evidence to the history of the gospel, is that in the concurrence of the multitudes who embraced it, and in the existence of those numerous churches and societies of men who espoused the profession of the Christian faith, we cannot but perceive, that every small interval of time betwixt the written testimonies of authors is filled up by materials so strong and so firmly cemented, as to present us with an unbroken chain of evidence, carrying as much authority along with it, as if it had been a diurnal record, commencing from the days of the apostles, and authenticated through its whole progress by the testimony of thousands.

84. Every convert to the Christian faith in these days, gives one additional testimony to the truth of the gospel his-

tory. Is he a Gentile? The sincerity of his testimony is approved by the persecutions, the sufferings, the danger, and often the certainty of martyrdom, which the profession of Christianity incurred. Is he a Jew? The sincerity of his testimony is approved by all these evidences, and in addition to them by this well known fact, that the faith and doctrine of Christianity was in the highest degree repugnant to the wishes and prejudices of that people. It ought never to be forgotten, that in as far as Jews are concerned, Christianity does not owe a single proselyte to its doctrines, but to the power and credit of its evidences, and that Judea was the chief theatre on which these evidences were exhibited. It cannot be too often repeated, that these evidences rest not upon arguments but upon facts, and that the time, and the place, and the circumstance, rendered these facts accessible to the enquiries of all who chose to be at the trouble of this examination. And there can be no doubt that this trouble was taken, whether we reflect on the nature of the Christian faith, as being so offensive to the pride and bigotry of the Jewish people, or whether we reflect on the consequences of embracing it, which were derision, and hatred, and banishment, and death. We may be sure, that a step which involved in it such painful sacrifices, would not be entered into upon light and insufficient grounds. In the sacrifices they made, the Jewish converts gave every evidence of having delivered an honest testimony in favour of the Christian miracles; and when we reflect, that many of them must have been eye-witnesses, and all of them had it in their power to verify these miracles, by conversation and correspondence with bye-standers, there can be no doubt, that it was not merely an honest, but a competent testimony. There is no fact better established, than that many thousands among the Jews believed in Jesus and his apostles; and we have therefore to allege their conversion, as a strong additional confirmation to the written testimony of the original historians.

The objection as to the general infidelity of the Jews considered.

85. One of the popular objections against the truth of the Christian miracles, is the general infidelity of the Jewish people. We are convinced, that at the moment of proposing this objection, an actual delusion exists in the mind of the infidel. In his conception, the Jews and the Christians stand opposed to each other. In the belief of the latter, he sees nothing but a party or an interested testimony, and in the unbelief of the former, he sees a whole people persevering in their antient faith, and resisting the new faith, on the ground of its insufficient evidences. He forgets all the while, that the testimony of a great many of these Christians, is in fact the testimony of Jews. He only attends to them in their present capacity. He contemplates them in the light of Christians, and annexes to them all that suspicion and incredulity which are generally annexed to the testimony of an interested party. He is aware of what they are at present, Christians and defenders of Christianity; but he has lost sight of their original situation, and is totally unmindful of this circumstance, that in their transition from Judaism to Christianity, they have given him the very evidence he is in quest of. Had another thousand of these Jews renounced the faith of their ancestors, and embraced the religion of Jesus, they would have been equivalent to a thousand additional testimonies in favour of Christianity, and testimonies too of the strongest and most unsuspicious kind, that can well be imagined. But this evidence would make no impression on the mind of an infidel, and the strength of it is disguised, even from the eyes of the Christian. These thousand, in the moment of their conversion, lose the appellation of Jews, and merge into the name and distinction of Christians. The Jews, though diminished in number, retain the national appellation; and the obstinacy with which they persevere in the belief of their ancestors, is still looked upon as the adverse testimony of an entire people. So long as one of that people continues a Jew, his testimony is looked upon as a serious impediment in the way of the Christian evidences. But the moment he becomes a Christian, his motives are contemplated with distrust. He is one of the obnoxious and suspected party. The mind carries a reference only to what he is, and not to what he has been. It overlooks the change of sentiment, and forgets, that in the renunciation of old habits, and old prejudices, in defiance to sufferings and disgrace, in attachment to a religion so repugnant to the pride and bigotry of their nation, and above all, in their submission to a system of doctrines which rested its authority on the miracles of their own time, and their own remembrance, every Jewish convert gives the most decisive testimony which man can give for the truth and divinity of our religion.

86. But why then, says the infidel, did they not all believe? Had the miracles of the gospel been true, we do not see how human nature could have held out against an evidence so striking and so extraordinary; nor can we at all enter into the obstinacy of that belief which is ascribed to the majority of the Jewish people, and which led them to shut their eyes against a testimony, that no man of common sense, we think, could have resisted?

87. Many Christian writers have attempted to resolve this difficulty, and to prove that the infidelity of the Jews, in spite of the miracles which they saw, is perfectly consistent with the known principles of human nature. For this purpose, they have enlarged, with much force and plausibility, on the strength and inveteracy of the Jewish prejudices—on the bewildering influence of religious bigotry upon the understanding of men—on the woeful disappointment which Christianity offered to the pride and interests of the nation—on the selfishness of the priesthood—and on the facility with which they might turn a blind and fanatical multitude, who had been trained, by their earliest habits, to follow and to revere them.

88. In the gospel history itself, we have a very consistent account at least of the Jewish opposition to the claims of our Saviour. We see the deeply wounded pride of a nation, that felt itself disgraced by the loss of its independence. We see the arrogance of its peculiar and exclusive claims to the favour of the Almighty. We see the anticipation of a great prince, who was to deliver them from the power and subjection of their enemies. We see their insolent contempt for the people of other countries, and the foullest scorn that they should be admitted to an equality with themselves in the honours and benefits of a revelation from heaven. We may easily conceive, how much the doctrine of Christ and his apostles was calculated to gall, and irritate, and disappoint them; how it must have mortified their national vanity; how it must have alarmed the jealousy of an artful and interested priesthood; and how it must have scandalized the great body of the people, by the liberality with which it addressed itself to all men, and to all nations, and raised to an elevation with themselves, those whom the firmest habits and prejudices of their country had led them to contemplate under all the disgrace and ignominy of outcasts.

89. Accordingly we know, in fact, that bitterness, and resentment, and wounded pride, lay at the bottom of a great deal of the opposition which Christianity experienced from the Jewish people. In the New Testament history itself, we see repeated examples of their outrageous violence, and this is confirmed by the testimony of many other writers. In the history of the martyr-

dom of Polycarp, it is stated, that the Gentiles and Jews inhabiting Smyrna, in a furious rage, and with a loud voice, cried out, "This is the teacher of Asia, the father of the Christians, the destroyer of our gods, who teacheth all men not to sacrifice, nor to worship them!" They collected wood, and the dried branches of trees, for his pile; and it is added, "the Jews also, according to custom, assisting with the greatest forwardness." It is needless to multiply testimonies to a point so generally understood. That it was not conviction alone which lay at the bottom of their opposition to the Christians; that a great deal of passion entered into it; and that their numerous acts of hostility against the worshippers of Jesus, carry in them all the marks of fury and resentment.

90. Now we know that the power of passion will often carry it very far over the power of conviction. We know that the strength of conviction is not in proportion to the quantity of evidence *presented*, but to the quantity of evidence *attended to*, and perceived, in consequence of that attention. We also know, that attention is, in a great measure, a voluntary act, and that it is often in the power of the mind, both to turn away its attention from what would land it in any painful or humiliating conclusion, and to deliver itself up exclusively to those arguments which flatter its taste and its prejudices. All this lies within the range of familiar and every day experience. We all know how much it ensures the success of an argument, when it gets a *favourable* hearing. In by far the greater number of instances, the parties in a litigation are not merely each *attached* to their own side of the question; but each *confident and believing* that theirs is the side on which the justice lies. In these contests of opinion, which take place every day betwixt man and man, and particularly if passion and interest have any share in the controversy, it is evident to the slightest observation, that though it might have been selfishness, in the first instance, which gave a peculiar direction to the understanding, yet each of the parties often comes, at last, to entertain a sincere conviction in the truth of his own argument. It is not that truth is not one and immutable. The whole difference lies in the observers, each of them viewing the object through the medium of his own prejudices, or cherishing those peculiar habits of attention and understanding to which taste or inclination had disposed him.

91. In addition to all this, we know, that though the evidence for a particular truth be so glaring, that it forces itself upon the understanding, and all the sophistry of passion and interest cannot withstand it; yet if this truth be of a very painful and humiliating kind, the obstinacy of man will often dispose him to resist its influence, and, in the bitterness of his malignant feelings, to carry a hostility against it, and that too in proportion to the weight of the argument which may be brought forward in its favour.

92. Now, if we take into account the inveteracy of the Jewish prejudices, and reflect how unpalatable and how mortifying to their pride must have been the doctrine of a crucified Saviour; we believe that their conduct, in reference to Christianity and its miraculous evidences, presents us with nothing anomalous or inexplicable, and that it will appear a possible and a likely thing to every understanding, that has been much cultivated in the experience of human affairs, in the nature of man, and the science of its character and phenomena.

93. There is a difficulty, however, in the way of this investigation. From the nature of the case, it bears no resemblance to any thing else, that has either been recorded in history, or has come within the range of our own personal observation. There is no other example of a people called upon to renounce the darling faith and principles of their country, and that upon the authority of miracles exhibited before them. All the experience we have about the operation of prejudice, and the perversion of the human temper and understanding, cannot afford a complete solution of the question. In many respects, it is a case *sui generis*, and the only creditable information which we can obtain, to enlighten us in this enquiry, is through the medium of that very testimony upon which the difficulty in question has thrown the suspicion that we want to get rid of.

94. Let us give all the weight to this argument of which it is susceptible, and the following is the precise degree in which it affects the merits of the controversy. When the religion of Jesus was promulgated in Judea, its first teachers appealed to miracles wrought by themselves in the face of day, as the evidence of their being commissioned by God. Many adopted the new religion upon this appeal, and many rejected it. An argument in favour of Christianity is derived from the conduct of the first. An objection against Christianity is derived from the conduct of the second. Now, allowing that we are not in possession of experience enough for estimating, in *absolute terms*, the strength of the objection, we propose the following as a solid and unexceptionable principle, upon which to estimate a comparison betwixt the strength of the objection and the strength of the argument. We are sure that the first would not have embraced Christianity had its miracles been false; but we are not sure beforehand, whether the second would have rejected this religion on the supposition of the miracles being true. If experience does not enlighten us as to how far the exhibition of a real miracle would be effectual in inducing men to renounce their old and favourite opinions, we can infer nothing decisive from the conduct of those who still kept by the Jewish religion. This conduct was a matter of uncertainty, and any argument which may be extracted from it cannot be depended upon. But the case is widely different with that party of their nation who were converted from Judaism to Christianity. We know that the alleged miracles of Christianity were perfectly open to examination. We are sure, from our experience of human nature, that in a question so interesting, this examination would be given. We know, from the very nature of the miraculous facts, so remote like every thing from what would be attempted by jugglery, or pretended to by enthusiasm, that, if this examination were given, it would fix the truth or falsehood of the miracles. The truth of these miracles, then, for any thing we know, may be consistent with the conduct of the Jewish party; but the falsehood of these miracles, from all that we do know of human nature, is not consistent with the conduct of the Christian party. Granting that we are *not sure* whether a miracle would force the Jewish nation to renounce their opinions, all that we can say of the conduct of the Jewish party is, that we are not able to explain it. But there is one thing that we *are sure* of. We are sure, that if the pretensions of Christianity be false, it never could have forced any part of the Jewish nation to renounce their opinions, with its alleged miracles, so open to detection, and its doctrines so offensive to every individual. The conduct of the Christian party then is not only what we are able to explain, but we can say with certainty, that it admits of no other explanation, than the truth of that hypothesis which we contend for. We may

not know in how far an attachment to existing opinions will prevail over an argument which is felt to be true; but we are sure, that this attachment will never give way to an argument which is perceived to be false; and particularly when danger, and hatred, and persecution, are the consequences of embracing it. The argument for Christianity, from the conduct of the first proselytes, rests upon the firm ground of experience. The objection against it, from the conduct of the unbelieving Jews, has no experience whatever to rest upon.

95. The conduct of the Jews may be considered as a solitary fact in the history of the world, not from its being an exception to the general principles of human nature, but from its being an exhibition of human nature in singular circumstances. We have no experience to guide us in our opinion as to the probability of this conduct; and nothing, therefore, that can impeach a testimony which all experience in human affairs leads us to repose in as unquestionable. But after this testimony is admitted, we may submit to be enlightened by it; and in the history which it gives us of the unbelieving Jews, it furnishes a curious fact as to the power of prejudice upon the human mind, and a valuable accession to what we before knew of the principles of our nature. It lays before us an exhibition of the human mind in a situation altogether unexampled, and furnishes us with the result of a singular experiment, if we may so call it, in the history of the species. We offer it as an interesting fact to the moral and intellectual philosopher, that a previous attachment may sway the mind even against the impression of a miracle; and those who believe not in the historical evidence which established the authority of Christ and of the apostles, would not believe, even though one rose from the dead.

96. We are inclined to think, that the argument has come down to us in the best possible form, and that it would have been enfeebled by that very circumstance, which the infidel demands as essential to its validity. Suppose for a moment, that we could give him what he wants, that all the priests and people of Judea were so borne down by the resistless evidence of miracles, as by one universal consent to become the disciples of the new religion. What interpretation might have been given to this unanimous movement in favour of Christianity? A very unfavourable one, we apprehend, to the authenticity of its evidences. Will the infidel say, that he has a higher respect for the credibility of those miracles which ushered in the dispensation of Moses, because they were exhibited in the face of a whole people, and gained their unexcepted submission to the laws and the ritual of Judaism? This new revolution would have received the same explanation. We would have heard of its being sanctioned by their prophecies, of its being agreeable to their prejudices, of its being supported by the countenance and encouragement of their priesthood, and that the jugglery of its miracles imposed upon all, because all were willing to be deceived by them. The actual form in which the history has come down, presents us with an argument free of all these exceptions. We, in the first instance, behold a number of proselytes, whose testimony to the facts of Christianity is approved of by what they lost and suffered in the maintenance of their faith; and we, in the second instance, behold a number of enemies, eager, vigilant, and exasperated at the progress of the new religion, who have not questioned the authenticity of our histories, and whose silence, as to the public and widely talked of miracles of Christ and his apostles, we have a right to interpret into the most triumphant of all testimonies.

The infidelity of the uncontroverted Gentiles considered.

97. The same process of reasoning is applicable to the cases of the Gentiles. Many adopted the new religion, and many rejected it. We may not be sure, if we can give an adequate explanation of the conduct of the latter, on the supposition that the evidences are true; but we are perfectly sure, that we can give no adequate explanation of the conduct of the former, on the supposition that the evidences are false. For any thing we know, it is possible that the one party may have adhered to their former prejudices, in opposition to all the force and urgency of argument, which even an authentic miracle carries along with it. But we know that it is not possible that the other party should renounce these prejudices, and that too in the face of danger and persecution, unless the miracles had been authentic. So great is the difference betwixt the strength of the argument and the strength of the objection, that we count it fortunate for the merits of the cause, that the conversions to Christianity were partial. We, in this way, secure all the support which is derived from the inexplicable fact of the silence of its enemies, inexplicable on every supposition, but the undeniable evidence and certainty of the miracles. Had the Roman empire made a unanimous movement to the new religion, and all the authorities of the state lent their concurrence to it, there would have been a suspicion annexed to the whole history of the gospel, which cannot at present apply to it; and from the collision of the opposite parties, the truth has come down to us in a far more unquestionable form than if no such collision had been excited.

98. The silence of Heathen and Jewish writers of that period, about the miracles of Christianity, has been much insisted upon by the enemies of our religion; and has even excited something like a painful suspicion in the breasts of those who are attached to its cause. Certain it is, that no ancient facts have come down to us, supported by a greater quantity of historical evidences, and better accompanied with all the circumstances which can confer credibility on that evidence. When we demand the testimony of Tacitus to the Christian miracles, we forget all the while that we can allege a multitude of much more decisive testimonies; no less than eight cotemporary authors, and a train of succeeding writers, who follow one another with a closeness and a rapidity, of which there is no example in any other department of ancient history. We forget that the authenticity of these different writers, and their pretensions to credit, are founded on considerations, perfectly the same in kind, though much stronger in degree, than what have been employed to establish the testimony of the most esteemed historians of former ages. For the history of the gospel, we behold a series of testimonies, more continuous, and more firmly sustained, than there is any other example of in the whole compass of erudition. And to refuse this evidence, is a proof, that in this investigation, there is an aptitude in the human mind to abandon all ordinary principles, and to be carried away by the delusions which we have already insisted on.

99. But let us try the effect of that testimony which our antagonists demand. Tacitus has actually attested the existence of Jesus Christ; the reality of such a personage; his public execution under the administration of Pontius Pilate; the temporary check which this gave to the progress of his religion; its revival a short time af-

ter his death ; its progress over the land of Judea, and to Rome itself, the metropolis of the empire ;—all this we have in a Roman historian ; and, in opposition to all established reasoning upon these subjects, it is by some more firmly confided in upon his testimony, than upon the numerous and concurring testimonies of nearer and cotemporary writers. But be this as it may, let us suppose that Tacitus had thrown one particular more into his testimony, and that his sentence had run thus : " They had their denomination from Christus, who, in the reign of Tiberius, was put to death as a criminal by the procurator Pontius Pilate, *and who rose from the dead on the third day after his execution, and ascended into heaven.*" Does it not strike every body, that however true the last piece of information may be, and however well established by its proper historians, this is not the place where we can expect to find it ? If Tacitus did not believe the resurrection of our Saviour, (which is probably the case, as he never, in all likelihood, paid any attention to the evidence of a faith which he was led to regard, from the outset, as a pernicious superstition, and a mere modification of Judaism), it is not to be supposed that such an assertion could ever have been made by him. If Tacitus did believe the resurrection of our Saviour, he gives us an example of what appears not to have been uncommon in these ages—he gives us an example of a man adhering to that system which interest and education recommended, in opposition to the evidence of a miracle which he admitted to be true. Still, even on this supposition, it is the most unlikely thing in the world, that he would have admitted the fact of our Saviour's resurrection into his history. It is most improbable, that a testimony of this kind would have been given, even though the resurrection of Jesus Christ be admitted ; and, therefore, the want of this testimony carries in it no argument that the resurrection is a falsehood. If, however, in opposition to all probability, this testimony had been given, it would have been appealed to as a most striking confirmation of the main fact of the evangelical history. It would have figured away in all our elementary treatises, and been referred to as a master argument in every exposition of the evidences of Christianity. Infidels would have been challenged to believe in it on the strength of their own favourite evidence, the evidence of a classical historian ; and must have been at a loss how to dispose of this fact, when they saw an unbiassed heathen giving his round and unqualified testimony in its favour.

100. Let us now carry the supposition a step farther. Let us conceive that Tacitus not only believed the fact, and gave his testimony to it, but that he believed it so far as to become a Christian. Is his testimony to be refused because he gives this evidence of its sincerity ? Tacitus asserting the fact, and remaining a heathen, is not so strong an argument for the truth of our Saviour's resurrection, as Tacitus asserting the fact and becoming a Christian in consequence of it. Yet the moment that this transition is made—a transition by which, in point of fact, it becomes stronger—in point of impression it becomes less ; and, by a delusion, common to the infidel and the believer, the argument is held to be weakened by the very circumstance which imparts greater force to it. The elegant and accomplished scholar becomes a believer. The truth, the novelty, the importance of this new subject, withdraws him from every other pursuit. He shares in the common enthusiasm of the cause, and gives all his talents and eloquence to the support of it. Instead of the Roman historian, Tacitus comes down to posterity in the shape of a Christian father, and the high authority of his name is lost in a crowd of similar testimonies.

101. A direct testimony to the miracles of the New Testament from the mouth of a heathen, is not to be expected. We cannot satisfy this demand of the infidel ; but we can give him a host of much stronger testimonies than he is in quest of—the testimonies of those men who were heathens, and who embraced a hazardous and a disgraceful profession, under a deep conviction of those facts to which they gave their testimony. " O, but you now land us in the testimony of Christians !" This is very true ; but it is the very fact of their being Christians in which the strength of the argument lies : and in each of the numerous fathers of the Christian church, we see a stronger testimony than the required testimony of the heathen Tacitus. We see men who, if they had not been Christians, would have risen to as high an eminence as Tacitus in the literature of the times ; and whose direct testimonies to the gospel history would, in that case, have been most impressive, even to the mind of an infidel. And are these testimonies to be less impressive, because they were preceded by conviction, and sealed by martyrdom ?

102. Yet though, from the nature of the case, no direct testimony to the Christian miracles from a heathen can be looked for, there are heathen testimonies which form an important accession to the Christian argument. Such are the testimonies to the state of Judea, the testimonies to those numerous particulars in government and customs which are so often alluded to in the New Testament, and give it the air of an authentic history. And, above all, the testimonies to the sufferings of the primitive Christians, from which we learn, through a channel clear of every suspicion, that Christianity, a religion of facts, was the object of persecution at a time, when eye-witnesses taught, and eye-witnesses must have bled for it.

103. The silence of Jewish and Heathen writers, when the true interpretation is given to it, is all on the side of the Christian argument. Even though the miracles of the gospel had been believed to be true, it is most unlikely that the enemies of the Christian religion would have given their testimony to them ; and the absence of this testimony is no impeachment therefore upon the reality of these miracles. But if the miracles of the gospel had been believed to be false, it is most likely that this falsehood would have been asserted by the Jews and Heathens of that period ; and the circumstance of no such assertion having been given, is a strong argument for the reality of these miracles. Their silence in not asserting the miracles is perfectly consistent with their truth ; but their silence in not denying them is not at all consistent with their falsehood. The entire silence of Josephus upon the subject of Christianity, though he wrote after the destruction of Jerusalem, and gives us the history of that period in which Christ and his apostles lived, is certainly a very striking circumstance. The sudden progress of Christianity at that time, and the fame of its miracles, (if not the miracles themselves,) form an important part of the Jewish history. How came Josephus to abstain from every particular respecting it ? Will you reverse every principle of criticism, and make the silence of Josephus carry it over the positive testimony of the many historical documents which have come down to us ? If you refuse every Christian testimony upon the subject, you will not refuse the testimony of Tacitus, who asserts, that this religion spread over Judea, and reached the city of Rome, and was looked upon as an evil of such importance, that it became the object of

an authorised persecution by the Roman government; and all this several years before the destruction of Jerusalem, and before Josephus composed his history. Whatever opinion may be formed as to the *truth* of Christianity, certain it is, that its *progress* constituted an object of sufficient magnitude to compel the attention of any historian who undertook the affairs of that period. How then shall we account for the scrupulous and determined exclusion of it from the history of Josephus? Had its miracles been false, this Jewish historian would gladly have exposed them. But its miracles were true, and silence was the only refuge of an antagonist, and his wisest policy.

The indirect testimony of Jews and Gentiles in favour of the gospel history.

104. But though we gather no direct testimony from Josephus, yet his history furnishes us with many satisfying additions to the Christian argument. In the details of policy and manners, he coincides in the main with the writers of the New Testament; and these coincidences are so numerous, and have so undesigned an appearance, as to impress on every person, who is at the trouble of making the comparison, the truth of the evangelical story.

105. If we are to look for direct testimonies to the miracles of the New Testament, we must look to that quarter, where alone it would be reasonable to expect them, to the writings of the Christian fathers, men who were not Jews or Heathens at the moment of recording their testimony; but who had been Jews or Heathens, and who, in their transition to the ultimate state of Christians, give a stronger evidence of integrity, than if they had believed these miracles, and persisted in a cowardly adherence to the safest profession.

106. We do not undertake to satisfy every demand of the infidel. We think we do enough, if we prove that the thing demanded is most unlikely, even though the miracles should be true; and therefore that the want of it carries no argument against the truth of the miracles. But we do still more than this, if we prove that the testimonies which we actually possess are much stronger than the testimonies he is in quest of. And who can doubt this, when he reflects, that the true way of putting the case betwixt the testimony of the Christian father, which we do have, and the testimony of Tacitus, which we do not have, is, that the latter would be an assertion not followed up by that conduct, which would have been the best evidence of its sincerity. Whereas, the former is an assertion substantiated by the whole life, and by the decisive fact of the old profession having been renounced, and the new profession entered into,—a change where disgrace, and danger, and martyrdom were the consequences.

107. Let us, therefore, enter into an examination of these testimonies.

A more particular exposition of the testimonies of the Christian writers.

108. This subject has been in part anticipated, when we treated of the authenticity of the books of the New Testament. We have quotations and references to these books from five apostolic fathers, the companions of the original writers. We have their testimonies sustained and extended by their immediate successors; and as we pursue this crowded series of testimonies downwards, they become so numerous, and so explicit, as to leave no doubt on the mind of the inquirers, that the different books of the New Testament are the publications of the authors, whose names they bear; and were received by the Christian world, as books of authority from the first period of their appearance.

109. Now, every sentence in a Christian father, expressive of respect for a book in the New Testament, is also expressive of his faith in its contents. It is equivalent to his testimony for the miracles recorded in it. In the language of the law, it is an act by which he homologates the record, and superinduces his own testimony to that of the original writers. It would be vain to attempt speaking of all these testimonies. It cost the meritorious Lardner many years to collect them. They are exhibited in his credibility of the new Testament; and in the multitude of them, we see a power and a variety of evidence for the Christian miracles, which is quite unequalled in the whole compass of ancient history.

110. But, in addition to these testimonies in the gross, for the truth of the evangelical history, have we no distinct testimonies to the individual facts which compose it? We have no doubt of the fact, that Barnabas was acquainted with the gospel by Matthew, and that he subscribed to all the information contained in that history. This is a most valuable testimony from a cotemporary writer; and a testimony which embraces all the miracles narrated by the evangelist. But, in addition to this, we should like if Barnabas, upon his own personal conviction, could assert the reality of any of these miracles. It would be multiplying the original testimonies; for he was a companion and a fellow-labourer of the apostles. We should have been delighted, if, in the course of our researches into the literature of past times, we had met with an authentic record, written by one of the five hundred, that are said to have seen our Saviour after his resurrection, and adding his own narrative of this event to the narratives that have already come down to us. Now, is any thing of this kind to be met with in ecclesiastical antiquity? How much of this kind of evidence are we in actual possession of? and if we have not enough to satisfy our keen appetites for evidence on a question of such magnitude, how is the want of it to be accounted for?

111. Let it be observed, then, that of the twenty-seven books which make up the New Testament, five are narrative or historical, viz. the four Gospels, and the Acts of the Apostles, which relate to the life and miracles of our Saviour, and the progress of his religion through the world, for a good many years after his ascension into heaven. All the rest, with the exception of the gospel by St John, are doctrinal or admonitory; and their main object is to explain the principles of the new religion, or to impress its duties upon the numerous proselytes who had even at that early period been gained over to the profession of Christianity.

112. Besides what we have in the New Testament, no other professed narrative of the miracles of Christianity has come down to us, bearing the marks of an authentic composition by any apostle, or any cotemporary of the apostles. Now, to those who regret this circumstance, we beg leave to submit the following observations. Suppose that one other narrative of the life and miracles of our Saviour had been composed, and, to give all the value to this additional testimony of which it is susceptible, let us suppose it to be the work of an apostle. By this last circumstance, we secure to its uttermost extent the advantage of an original testimony, the testimony of another eye-witness, and constant companion of our Saviour. Now, we ask, what would have been the fate of this performance? It would have been incorporated into the New Testament along with the other gospels. It may have been the gospel according to Philip. It may have been the gospel according to Bartholomew. At all events, the whole amount of the advantage would have been, the substitution of five gospels instead of four, and this addition, the want of which is so much complained

of, would scarcely have been felt by the Christians, or acknowledged by the infidel to strengthen the evidence which we are already in possession of.

113. But to vary the supposition, let us suppose that the narrative wanted, instead of being the work of an apostle, had been the work of some other cotemporary, who writes upon his own original knowledge of the subject, but was not so closely associated with Christ, or his immediate disciples, as to have his history admitted in the canonical scriptures. Had this history been preserved, it would have been transmitted to us in a separate state, it would have stood out from among that collection of writings, which passes under the general name of the New Testament, and the additional evidence thus afforded, would have come down in the form most satisfactory to those with whom we are maintaining our present argument. Yet though, in point of form, the testimony might be more satisfactory; in point of fact, it would be less so. It is the testimony of a less competent witness,—a witness who, in the judgment of his cotemporaries, wanted those accomplishments which entitled him to a place in the New Testament. There must be some delusion operating upon the understanding, if we think that a circumstance, which renders an historian less accredited in the eyes of his own age, should render him more accredited in the eyes of posterity. Had Mark been kept out of the New Testament, he would have come down to us in that form, which would have made his testimony more impressive to a superficial enquirer; yet there would be no good reason for keeping him out, but precisely that reason which should render his testimony less impressive. We do not complain of this anxiety for more evidence, and as much of it as possible; but it is right to be told, that the evidence we have is of far more value than the evidence demanded, and that, in the concurrence of four canonical narratives, we see a far more effectual argument for the miracles of the New Testament, than in any number of those separate and extraneous narratives, the want of which is so much felt, and so much complained of.

114. That the New Testament is not one, but a collection of many testimonies, is what has been often said, and often acquiesced in. Yet even after the argument is formally acceded to, its impression is unfelt; and on this subject there is a great and an obstinate delusion, which not only confirms the infidel in his disregard to Christianity, but even veils the strength of the evidence from its warmest admirers.

115. There is a difference betwixt a mere narrative and a work of speculation or morality. The latter subjects embrace a wider range, admit a greater variety of illustration, and are quite endless in their application to the new cases that occur in the ever-changing history of human affairs. The subject of a narrative again admits of being exhausted. It is limited by the number of actual events. True, you may expatiate upon the character or importance of these events, but, in so doing, you drop the office of the pure historian, for that of the politician, or the moralist, or the divine. The evangelists give us a very chaste and perfect example of the pure narrative. They never appear in their own persons, or arrest the progress of the history for a single moment, by interposing their own wisdom, or their own piety. A gospel is a bare relation of what has been said or done; and it is evident that, after a few good compositions of this kind, any future attempts would be superfluous and uncalled for.

116. But, in point of fact, these attempts were made. It is to be supposed, that, after the singular events of our Saviour's history, the curiosity of the public would be awakened, and there would be a demand for written accounts of such wonderful transactions. These written accounts were accordingly brought forward. Even in the interval of time betwixt the ascension of our Saviour, and the publication of the earliest gospel, such written histories seem to have been frequent. "Many," says St Luke, (and in this he is supported by the testimony of subsequent writers,) "have taken in hand to set forth in order a declaration of these things." Now what has been the fate of all these performances? Such as might have been anticipated. They fell into disuse and oblivion. There is no evil design ascribed to the authors of them. They may have been written with perfect integrity, and been useful for a short time, and within a limited circle; but, as was natural, they all gave way to the superior authority, and more complete information of our present narratives. The demand of the Christian world was withdrawn from the less esteemed, to the more esteemed histories of our Saviour. The former ceased to be read, and copies of them would be no longer transcribed or multiplied. We cannot find the testimony we are in quest of, not because it was never given, but because the early Christians, who were the most competent judges of that testimony, did not think it worthy of being transmitted to us.

117. But, though the number of narratives be necessarily limited by the nature of the subject, there is no such limitation upon works of a moral, didactic, or explanatory kind. Many such pieces have come down to us, both from the apostles themselves, and from the earlier fathers of the church. Now, though the object of these compositions is not to deliver any narrative of the Christian miracles, they may perhaps give us some occasional intimation of them, they may proceed upon their reality. We may gather either from incidental passages, or from the general scope of the performance, that the miracles of Christ and his apostles were recognised, and the divinity of our religion acknowledged, as founded upon these miracles.

118. The first piece of the kind which we meet with, besides the writings of the New Testament, is an epistle ascribed to Barnabas, and, at all events, the production of a man, who lived in the days of the apostles. It consists of an exhortation to constancy in the Christian profession, a dissuasive from Judaism, and other moral instructions. We shall only give a quotation of a single clause from this work. "And he (i. e. our Saviour) making great signs and prodigies to the people of the Jews, they neither believed nor loved him."

119. The next piece in the succession of Christian writers, is the undoubted epistle of Clement, the bishop of Rome, to the church of Corinth, and who, by the concurrent voice of all antiquity, is the same Clement who is mentioned in the epistle to the Philippians, as the fellow-labourer of Paul. It is written in the name of the church of Rome, and the object of it is to compose certain dissensions which had arisen in the church of Corinth. It was out of his way to enter into any thing like a formal narrative of the miraculous facts which are to be found in the evangelical history. The subject of his epistle did not lead him to this; and besides, the number and authority of the narratives already published, rendered an attempt of this kind altogether superfluous. Still, however, though a miracle may not be formally announced, it may be brought in incidentally, or it may be proceeded upon, or assumed as the basis of an argument. We give one or two examples of this. In one part of his epistle, he illustrates the doctrine of our resurrection from the

dead, by the change and progression of natural appearances, and he ushers in this illustration with the following sentence: "Let us consider, my beloved, how the Lord shows us our future resurrection perpetually, of which he made the Lord Jesus Christ the first fruits, by raising him from the dead." This incidental way of bringing in the fact of our Lord's resurrection, appears to us the strongest possible form in which the testimony of Clement could have come down to us. It is brought forward in the most confident and unembarrassed manner. He does not stop to confirm this fact by any strong asseveration, nor does he carry, in his manner of announcing it, the most remote suspicion of its being resisted by the incredulity of those to whom he is addressing himself. It wears the air of an acknowledged truth, a thing understood and acquiesced in by all the parties in this correspondence. The direct narrative of the evangelists gives us their original testimony to the miracles of the gospel. The artless and indirect allusions of the apostolic fathers, give us not merely their faith in this testimony, but the faith of the whole societies to which they write. They let us see, not merely that such a testimony was given, but that such a testimony was generally believed, and that too at a time when the facts in question lay within the memory of living witnesses.

120. In another part, speaking of the apostles, Clement says, that "receiving the commandments, and being filled with full certainty by the resurrection of Jesus Christ, and confirmed by the word of God, with the assurance of the Holy Spirit, they went out announcing the advent of the kingdom of God."

121. It was no object, in those days, for a Christian writer to come over the miracles of the New Testament, with the view of lending his formal and explicit testimony to them. This testimony had already been completed to the satisfaction of the whole Christian world. If much additional testimony has not been given, it is because it was not called for. But we ought to see, that every Christian writer, in the fact of his being a Christian, in his expressed reverence for the books of the New Testament, and in his numerous allusions to the leading points of the gospel history, has given as satisfying evidence to the truth of the Christian miracles, as if he had left behind him a copious and distinct narrative.

122. Of all the miracles of the gospel, it was to be supposed, that the resurrection of our Saviour would be oftenest appealed to; not as an evidence of his being a teacher,—for that was a point so settled in the mind of every Christian, that a written exposition of the argument was no longer necessary,—but as a motive to constancy in the Christian profession, and as the great pillar of hope in our own immortality. We accordingly meet with the most free and confident allusions to this fact in the early fathers. We meet with five intimations of this fact in the undoubted epistle of Polycarp to the Philippians: a father who had been educated by the apostles, and conversed with many who had seen Christ.

123. It is quite unnecessary to exhibit passages from the epistles of Ignatius to the same effect, or to pursue the examination downwards through the series of written testimonies. It is enough to announce it as a general fact, that, in the very first age of the Christian church, the teachers of this religion proceeded as confidently upon the reality of Christ's miracles and resurrection in their addresses to the people, as the teachers of the present day: Or, in other words, that they were as little afraid of being resisted by the incredulity of the people, at a time when the evidence of the facts was accessible to all, and habit and prejudice were against them, as we are of being resisted by the incredulity of an unlettered multitude, who listen to us with all the veneration of a hereditary faith.

124. There are five apostolic fathers, and a series of Christian writers who follow after them in rapid succession. To give an idea to those who are not conversant in the study of ecclesiastical antiquities, how well sustained the chain of testimony is from the first age of Christianity, we shall give a passage from a letter of Irenæus, preserved by Eusebius. We have no less than nine compositions from different authors, which fill up the interval betwixt him and Polycarp; and yet this is the way in which he speaks, in his old age, of the venerable Polycarp, in a letter to Florinus. "I saw you, when I was very young, in the Lower Asia with Polycarp. For I better remember the affairs of that time than those which have lately happened: the things which we learn in our childhood growing up in the soul, and uniting themselves to it. Insomuch, that I can tell the place in which the blessed Polycarp sat and taught, and his going out, and coming in, and the manner of his life, and the form of his person, and his discourses to the people; and how he related his conversation with John, and others who had seen the Lord; and how he related their sayings, and what he had heard from them concerning the Lord, both concerning his miracles and his doctrines, as he had received them from the eye-witnesses of the Word of Life: all which Polycarp related agreeably to the Scriptures. These things I then, through the mercy of God toward me, diligently heard and attended to, recording them not on paper, but upon my heart."

They lead the mind back to the number and weight of the original testimonies.

125. Now is the time to exhibit to full advantage the argument which the different epistles of the New Testament afford. They are, in fact, so many distinct and additional testimonies. If the testimonies drawn from the writings of the Christian fathers are calculated to make any impression, then the testimonies of these epistles, where there is no delusion, and no prejudice in the mind of the inquirer, must make a greater impression. They are more ancient, and were held to be of greater authority by competent judges. They were held sufficient by the men of these days, who were nearer to the sources of evidence; and they ought, therefore, to be held sufficient by us. The early persecuted Christians had too great an interest in the grounds of their faith, to make a light and superficial examination. We may safely commit the decision to them; and the decision they have made, is, that the authors of the different epistles in the New Testament, were worthier of their confidence, as witnesses of the truth, than the authors of those compositions which were left out of the collection, and maintain, in our eye, the form of a separate testimony. By what unaccountable tendency is it, that we feel disposed to reverse this decision, and to repose more faith in the testimony of subsequent and less esteemed writers? Is there any thing in the confidence given to Peter and Paul by their cotemporaries, which renders them unworthy of ours? or, is the testimony of their writings less valuable and less impressive, because the Christians of old have received them as the best vouchers of their faith?

126. It gives us a far more satisfying impression than ever of the truth of our religion, when, in addition to several distinct and independent narratives of its history, we meet with a number of contemporaneous productions addressed to different societies, and all proceeding upon the truth of that history, as an agreed and unquestionable point amongst the different parties in the correspondence. Had that history been a fabrication, in what manner, we

ask, would it have been followed up by the subsequent compositions of those numerous agents in the work of deception? How comes it, that they have betrayed no symptom of that insecurity which it would have been so natural to feel in their circumstances? Through the whole of these epistles, we see nothing like the awkward or embarrassed air of an impostor. We see no anxiety, either to mend or to confirm the history that had already been given. We see no contest which they might have been called upon to maintain with the incredulity of their converts, as to the miracles of the gospel. We see the most intrepid remonstrance against errors of conduct, or discipline, or doctrine. This savours strongly of upright and independent teachers; but is it not a most striking circumstance, that, amongst the severe reckonings which St Paul had with some of his churches, he was never once called upon to school their doubts, or their suspicions, as to the reality of the Christian miracles? This is a point universally acquiesced in; and, from the general strain of these epistles, we collect, not merely the testimony of their authors, but the unsuspected testimony of all to whom they addressed themselves.

127. And let it never be forgotten, that the Christians who composed these churches, were in every way well qualified to be arbiters in this question. They had the first authorities within their reach. The five hundred who, Paul says to them, had seen our Saviour after his resurrection, could be sought after; and if not to be found, Paul would have had his assertion to answer for. In some cases, they were the first authorities themselves, and had therefore no confirmation to go in search of. He appeals to the miracles which had been wrought among them, and in this way he commits the question to their own experience. He asserts this to the Galatians; and at the very time, too, that he is delivering against them a most severe and irritating invective. He intimates the same thing repeatedly to the Corinthians; and after he had put his honesty to so severe a trial, does he betray any insecurity as to his character and reputation amongst them? So far from this, that in arguing the general doctrine of resurrection from the dead, as the most effectual method of securing assent to it, he rests the main part of the argument upon their confidence in his fidelity as a witness. "But if there be no resurrection from the dead, then is Christ not risen. - - - - Yea, and we are found false witnesses of God, because we have testified of God, that he raised up Christ, whom he raised not up, if so be that the dead rise not." Where, we ask, would have been the mighty charm of this argument, if Paul's fidelity had been questioned; and how shall we account for the free and intrepid manner in which he advances it, if the miracles which he refers to, as wrought among them, had been nullities of his own invention?

128. For the truth of the gospel history, we can appeal to one strong and unbroken series of testimonies from the days of the apostles. But the great strength of the evidence lies in that effulgence of testimony, which enlightens this history at its commencement—in the number of its original witnesses—in the distinct and independent records which they left behind them, and in the undoubted faith they bore among the numerous societies which they instituted. The concurrence of the apostolic fathers, and their immediate successors, forms a very strong and a very satisfying argument; but let it be further remembered, that out of the materials which compose, if we may be allowed the expression, the original charter of our faith, we can select a stronger body of evidence than it is possible to form out of the whole mass of subsequent testimonies.

Prophecy.

129. Prophecy is another species of evidence which Christianity professes an abundant claim to, and which can be established on evidence altogether distinct from the testimony of its supporters. The prediction of what is future may not be delivered in terms so clear and intelligible as the history of what is past; and yet, in its actual fulfilment, it may leave no doubt on the mind of the enquirer that it was a prediction, and that the event in question was in the contemplation of him who uttered it. It may be easy to dispose of one isolated prophecy, by ascribing it to accident; but when we observe a number of these prophecies, delivered in different ages, and all bearing an application to the same events, or the same individual, it is difficult to resist the impression that they were actuated by a knowledge superior to human.

130. The obscurity of the prophetical language has been often complained of; but it is not so often attended to, that if the prophecy which fortels an event were as clear as the narrative which describes, it would in many cases annihilate the argument. Were the history of any individual foretold in terms as explicit as it is in the power of narrative to make them, it might be competent for any usurper to set himself forward, and in as far as it depended upon his own agency, he might realize that history. He has no more to do than to take his lesson from the prophecy before him; but could it be said that fulfilment like this carried in it the evidence of any thing divine or miraculous? If the prophecy of a Prince and a Saviour, in the Old Testament, were different from what they are, and delivered in the precise and intelligible terms of an actual history; then every accomplishment which could be brought about by the agency of those who understood the prophecy, and were anxious for its verification, is lost to the argument. It would be instantly said that the agents in the transaction took their clue from the prophecy before them. It is the way, in fact, in which infidels have attempted to evade the argument as it actually stands. In the New Testament, an event is sometimes said to happen that *it might be fulfilled*, what was spoken by some of the old prophets. If every event which enters into the gospel had been under the controul of agents merely human, and friends to Christianity; then we might have had reason to pronounce the whole history to be one continued process of artful and designed accommodation to the Old Testament prophecies. But the truth is, that many of the events pointed at in the Old Testament, so far from being brought about by the agency of Christians, were brought about in opposition to their most anxious wishes. Some of them were brought about by the agency of their most decided enemies; and some of them, such as the dissolution of the Jewish state, and the dispersion of its people amongst all countries, were quite beyond the controul of the apostles and their followers, and were effected by the intervention of a neutral party, which at the time took no interest in the question, and which was a stranger to the prophecy, though the unconscious instrument of its fulfilment.

131. Lord Bolingbroke has carried the objection so far, that he asserts Jesus Christ to have brought on his own death, by a series of wilful and preconcerted measures, merely to give the disciples who came after him the triumph of an appeal to the old prophecies. This is ridiculous enough; but it serves to shew with what facility an infidel might have evaded the whole argument, had these prophecies been free of all that obscurity which is now so loudly complained of.

132. The best form for the purposes of argument in which a prophecy can be delivered, is to be so obscure, as

to leave the event, or rather its main circumstances, unintelligible before the fulfilment, and so clear as to be intelligible after it. It is easy to conceive that this may be an attainable object; and it is saving much for the argument as it stands, that this happiest illustrations of the clearness on the one hand, and this obscurity on the other, are to be gathered from the actual prophecies of the Old Testament.

133. It is not, however, by this part of the argument, that we expect to reclaim the enemy of our religion from his infidelity; not that the examination would not satisfy him, but that the examination will not be given. What a violence it would be offering to all his antipathies, were we to land him, at the outset of our discussions, among the chapters of Daniel or Isaiah! He has too inveterate a contempt for the Bible. He nauseates the whole subject too strongly to be prevailed upon to accompany us to such an exercise. On such a subject as this, there is no contrast, no approximation betwixt us; and we leave him with the assertion, (an assertion which he has no title to pronounce upon, till after he has finished the very examination which we are most anxious to engage him in), that in the numerous prophecies of the Old Testament, there is such a multitude of allusions to the events of the New, as will give a strong impression to the mind of every enquirer, that the whole forms one magnificent series of communications betwixt the visible and the invisible world; a great plan over which the unseen God presides in wisdom, and which, beginning with the first ages of the world, is still receiving new developements from every great step in the history of the species.

134. It is impossible to give a complete exposition of this argument without an actual reference to the prophecies themselves; and this would lead us far beyond the limits of our article. But it can be conceived, that a prophecy, when first announced, may be so obscure, as to be unintelligible in many of its circumstances; and yet may so far explain itself by its accomplishment, as to carry along with it the most decisive evidence of its being a prophecy. And the argument may be so far strengthened by the number, and distance, and independence, of the different prophecies, all bearing an application to the same individual and the same history, as to leave no doubt on the mind of the observer, that the events in question were in the actual contemplation of those who uttered the prediction. If the terms of the prophecy were not comprehended, it at least takes off the suspicion of the event being brought about by the controul or agency of men who were interested in the accomplishment. If the prophecies of the Old Testament are just invested in such a degree of obscurity, as is enough to disguise many of the leading circumstances from those who lived before the fulfilment,—while they derive from the event an explanation satisfying to all who live after it, then, we say, the argument for the divinity of the whole is stronger, than if no such obscurity had existed. In the history of the New Testament, we see a natural and consistent account of the delusion respecting the Messiah, in which this obscurity had left the Jewish people—of the strong prejudices, even of the first disciples—of the manner in which these prejudices were dissipated, only by the accomplishment—and of their final conviction in the import of these prophecies being at last so strong, that it often forms their main argument for the divinity of that new religion which they were commissioned to publish to the world. Now, assuming, what we still persist in asserting, and ask to be tried upon, that an actual comparison of the prophecies in the Old Testament, with their alleged fulfilment in the New, will leave a conviction behind it, that there is a real correspondence betwixt them; we see, in the great events of the new dispensation brought about by the blind instrumentality of prejudice and opposition, far more unambiguous characters of the finger of God, than if every thing had happened with the full concurrence and anticipation of the different actors in this history.

135. There is another essential part of the argument, which is much strengthened by this obscurity. It is necessary to fix the date of the prophecies, or to establish, at least, that the time of their publication was antecedent to the events to which they refer. Now, had these prophecies been delivered in terms so explicit, as to force the concurrence of the whole Jewish nation, the argument for their antiquity, would not have come down in a form as satisfying, as that in which it is actually exhibited. The testimony of the Jews, to the date of their sacred writings, would have been refused as an interested testimony. Whereas, to evade the argument as it stands, we must admit a principle, which, in no question of ordinary criticism, would be suffered for a single moment to influence your understanding. We must conceive, that two parties, at the very time that they were influenced by the strongest mutual hostility, combined to support a fabrication; that they have not violated this combination; that the numerous writers on both sides of the question have not suffered the slightest hint of this mysterious compact to escape them; and that, though the Jews are galled incessantly by the triumphant tone of the Christian appeals to their own prophecies, they have never been tempted to let out a secret, which would have brought the argument of the Christians into disgrace, and shown the world, how falsehood and forgery mingled with their pretensions.

136. In the rivalry which, from the very commencement of our religion, has always obtained betwixt Jews and Christians, in the mutual animosities of Christian sects, in the vast multiplication of copies of the scriptures, in the distant and independent societies which were scattered over so many countries, we see the most satisfying pledge, both for the integrity of the sacred writings, and for the date which all parties agree in ascribing to them. We hear of the many securities which have been provided in the various forms of registrations, and duplicates, and depositories; but neither the wisdom, nor the interests of men, ever provided more effectual checks against forgery and corruption, than we have in the instance before us. And the argument, in particular, for the antecedence of the prophecies to the events in the New Testament, is so well established by the concurrence of the two rival parties, that we do not see, how it is in the power of additional testimony to strengthen it.

137. But neither is it true, that the prophecies are delivered in terms so obscure, as to require a painful examination, before we can obtain a full perception of the argument. Those prophecies which relate to the fate of particular cities, such as Nineveh, and Tyre, and Babylon; those which relate to the issue of particular wars, in which the kings of Israel and Judah were engaged; and some of those which relate to the future history of the adjoining countries, are not so much veiled by symbolical language, as to elude the understanding, even of the most negligent observers. It is true, that in these instances, both the prophecy and the fulfilment appear to us in the light of a distant antiquity. They have accomplished their end. They kept alive the faith and worship of successive generations. They multiplied the evidences of the true

religion, and account for a phenomenon in ancient history that is otherwise inexplicable, the existence and preservation of one solitary monument of pure theism in the midst of a corrupt and idolatrous world.

138. But to descend a little further. We gather from the state of opinions at the time of our Saviour so many testimonies to the clearness of the old prophecies. The time and the place of our Saviour's appearance in the world, and the triumphant progress, if not the nature of his kingdom, were perfectly understood by the priests and chief men of Judea. We have it from the testimony of profane authors, that there was, at that time, a general expectation of a prince and a prophet all over the East. The destruction of Jerusalem was another example of the fulfilment of a clear prophecy; and this, added to other predictions uttered by our Saviour, and which received their accomplishment in the first generation of the Christian church, would have its use in sustaining the faith of the disciples amidst the perplexities of that anxious and distressing period.

139. We can even come down to the present day, and point to the accomplishment of clear prophecies in the actual history of the world. The present state of Egypt, and the present state of the Jews, are the examples which we fix upon. The one is an actual fulfilment of a clear prophecy; the other is also an actual fulfilment, and forms in itself the likeliest preparation for another accomplishment that is yet to come. Nor do we conceive, that these clear and literal fulfilments exhaust the whole of the argument from prophecy. They only form one part of the argument, but a part so obvious and irresistible, as should invite every lover of truth to the examination of the remainder. They should secure such a degree of respect for the subject, as to engage the attention, and awaken even in the mind of the most rapid and superficial observer, a suspicion that there may be something in it. They should soften that contempt which repels so many from investigating the argument at all, or at all events, they render that contempt inexcusable.

140. The whole history of the Jews is calculated to allure the curiosity, and had it not been leagued with the defence and illustration of our faith, would have drawn the attention of many a philosopher, as the most singular exhibition of human nature that ever was recorded in the annals of the world. The most satisfying cause of this phenomenon is to be looked for in the history, which describes its origin and progress; and by denying the truth of that history, you abandon the only explanation which can be given of this wonderful people. It is quite in vain to talk of the immutability of Eastern habits, as exemplified in the nations of Asia. What other people ever survived the same annihilating processes? We do not talk of conquest, where the whole amount of the effect is in general a change of dynasty or of government; but where the language, the habits, the denomination, and above all, the geographical position, still remain to keep up the identity of the people. But in the history of the Jews, we see a strong indestructible principle, which maintained them in a separate form of existence amid changes that no other nation ever survived. We confine ourselves to the overthrow of their nation in the first century of our epoch, and appeal to the disinterested testimonies of Tacitus and Josephus, if ever the cruelty of war devised a process of more terrible energy for the utter extirpation of a name, and a remembrance from the world. They have been dispersed among all countries. They have no common tie of locality or government to keep them together. All the ordinary principles of assimilation, which make law, and religion, and manners, so much a matter of geography, are in their instance suspended. Even the smallest particles of this broken mass have resisted an affinity of almost universal operation, and remain undiluted by the strong and overwhelming admixture of foreign ingredients. And in exception to every thing which history has recorded of the revolutions of the species, we see in this wonderful race a vigorous principle of identity which has remained in undiminished force for nearly two thousand years, and still pervades every shred and fragment of their widely scattered population. Now, if the infidel insists upon it, we shall not rest on this as an argument. We can afford to give it up; for in the abundance of our resources, we feel independent of it. We shall say that it is enough, if it can reclaim him from his levity, and compel his attention to the other evidences which we have to offer him. All we ask of him is to allow, that the undeniable singularity which is before his eyes, gives him a sanction at least, to examine the other singularities which we make pretension to. If he goes back to the past history of the Jews, he will see in their wars the same unexampled preservation of their name and their nation. He will see them surviving the process of an actual transportation into another country. In short, he will see them to be unlike all other people in what observation offers, and authentic history records of them; and the only concession that we demand of him from all this, is, that their pretension to be unlike other people in their extraordinary revelations from heaven is at least possible, and deserves to be enquired into.

141. It may not be out of place to expose a species of injustice, which has often been done to the Christian argument. The defence of Christianity consists of several distinct arguments, which have sometimes been multiplied beyond what is necessary, and even sometimes beyond what is tenable. In addition to the main evidence which lies in the testimony given to the miracles of the gospel, there is the evidence of prophecy; there is the evidence of collateral testimony; there is the internal evidence. The argument under each of these heads, is often made to undergo a farther subdivision; and it is not to be wondered at, that, in the multitude of observations, the defence of Christianity may often be made to rest upon ground, which, to say the least of it, is precarious or vulnerable. Now the injustice which we complain of is, that when the friends of our religion are dislodged from some feeble outwork, raised by an unskilful officer in the cause, its enemies raise the cry of a decisive victory. But, for our own part, we could see her driven from all her defences, and surrender them without a sigh, so long as the phalanx of her historical evidence remains impenetrable. Behind this unscaled barrier, we could entrench ourselves, and eye the light skirmishing before us with no other sentiment than of regret, that our friends should, by the eagerness of their misplaced zeal, have given our enemy the appearance of a triumph.

142. We offer no opinion as to the two-fold interpretation of prophecy; but though it were refuted by argument, and disgraced by ridicule, all that portion of evidence which lies in the numerous examples of literal and unambiguous fulfilment remains unaffected by it. Many there are, who deny the inspiration of the Song of Solomon. But in what possible way does this affect the records of the evangelical history? Just as much as it affects the Lives of Plutarch, or the Annals of Tacitus. There are a thousand subjects in which infidels may idly push the triumph, and Christians be as idly galled by the severity, or even the truth of their observations. We point to the historical evidence for the New

Testament, and ask them to dispose of it. It is there, that we call them to the onset; for there lies the main strength of the Christian argument. It is true, that in the evidence of prophecy, we see a rising barrier, which, in the progress of centuries, may receive from time to time a new accumulation to the materials which form it. In this way, the evidence of prophecy may come in time to surpass the evidence of miracles. The restoration of the Jews will be the fulfilment of a clear prophecy, and form a proud and animating period in the history of our religion, "the fall of them the riches of the world, and the diminishing of them the riches of the Gentiles, how much more their fulness?"

Geological objections considered.

143. The late speculations in geology form another example of a distant and unconnected circumstance, being suffered to cast an unmerited disgrace over the whole of the argument. They give a higher antiquity to the world, than most of those who read the Bible had any conception of. Admit this antiquity, and in what possible way does it touch upon the historical evidence for the New Testament? The credibility of the gospel miracles stands upon its own appropriate foundation, the recorded testimony of numerous and unexceptionable witnesses. The only way in which we can overthrow that credibility is by attacking the testimony, or disproving the authenticity of the record. Every other science is tried upon its own peculiar evidences; and all we contend for is, that the same justice be done to theology. When a mathematician offers to apply his reasoning to the phenomena of mind, the votaries of moral science resent it as an invasion, and make their appeal to the evidence of consciousness. When an amateur of botany, upon some vague analogies, offers his confident affirmations as to the structure and parts of the human body, there would be an instantaneous appeal to the knife and demonstrations of the anatomist. Should a mineralogist, upon the exhibition of an ingenious or well-supported theory, pronounce upon the history of our Saviour and his miracles, we would call it another example of an arbitrary and unphilosophical extension of principles beyond the field of their legitimate application. We would appeal to the kind and the quantity of testimony upon which that history is supported. We would suffer ourselves to be delighted by the brilliancy, or even convinced by the evidence of his speculations, but we would feel that the history of these facts, which form the groundwork of our faith, is as little affected by them, as the history of any storm, or battle, or warrior, which has come down to us in the most genuine and approved records of past ages.

144. But whatever be the external evidence of testimony, or however strong may be its visible characters of truth and honesty, is not the falsehood or the contradiction which we may detect in the subject of that testimony sufficient to discredit it? Had we been original spectators of our Saviour's miracles, we must have had as strong a conviction of their reality, as it is in the power of testimony to give us. Had we been the eye-witnesses of his character and history, and caught from actual observation the impression of his worth, the internal proofs, that no jugglery or falsehood could have been intended, would have been certainly as strong as the internal proofs which are now exhibited to us, and which consist in the simplicity of the narrative, and that tone of perfect honesty which pervades in a manner so distinct and intelligible every composition of the apostles. Yet, with all these advantages, if Jesus Christ had asserted as a truth, what we confidently know to be a falsehood; had he, for example, upon the strength of his prophetical endowments, pronounced upon the secret of a person's age, and told us that he was thirty, when we knew him to be forty, would not this have made us stumble at all his pretensions, and, in spite of every other argument and appearance, would we not have withdrawn our confidence from him as a teacher from God? This we allow would have been a most serious dilemma. It would have been that state of neutrality which admits of nothing positive or satisfying on either side of the question; or rather, what is still more distressing, which gave me the most positive and satisfactory appearances on both sides. We could not abandon the truth of the miracles, because we saw them. Could we give them up, we should determine on a positive rejection, and our minds would find repose in absolute infidelity. But as the case stands, it is scepticism. There is nothing like it in any other department of inquiry. We can appeal to no actual example; but a student of natural science may be made to understand the puzzle. When he asks him, how he would act, if the experiments, which he conducts under the most perfect sameness of circumstances, were to land him in opposite results? He would vary and repeat his experiments. He would try to detect the inconsistency, and would rejoice, if he at last found, that the difficulty lay in the errors of his own observation, and not in the inexplicable nature of the subject. All this he would do in anxious and repeated endeavours, before he inferred that nature persevered in no law, and that that constancy, which is the foundation of all science, was perpetually broke in upon by the most capricious and unlooked for appearances, before he would abandon himself to scepticism, and pronounce philosophy to be an impossible attainment.

145. It is our part to imitate this example. If Jesus Christ has, on the one hand, performed miracles, and sustained in the whole tenour of his history the character of a prophet, and, on the other hand, asserted to be true, what we undeniably know to be a falsehood, this is a dilemma which we are called upon to resolve by every principle, that can urge the human mind in the pursuit of liberal inquiry. It is not enough to say, that the phenomena in question do not fall within the dominion of philosophy; and we therefore leave them as a fair exercise and amusement to commentators. The mathematician may say, and has said the same thing of the moralist; yet there are moralists in the world, who will prosecute their speculations in spite of him; and what is more, there are men who take a wider survey than either, who rise above these professional prejudices, and will allow that, in each department of inquiry, the subjects which offer are entitled to a candid and respectful consideration. The naturalist may pronounce the same rapid judgment upon the difficulties of the theologian; yet there ever will be theologians who feel a peculiar interest in their subject; and we trust that there ever will be men, with a higher grasp of mind than either the mere theologian, or the mere naturalist, who are ready to acknowledge the claims of truth in every quarter,—who are superior to that narrow contempt, which has made such an unhappy and malignant separation among the different orders of scientific men,—who will examine the evidences of the gospel history, and, if they are found to be sufficient, will view the miracles of our Saviour with the same liberal and philosophic curiosity with which they would contemplate any grand phenomenon in the moral history of the species. If there really appears, on the face of this investigation, to be such a difficulty as the one in question, a philosopher of the order we are now describing will make many an anxious effort to extricate himself; he will not soon acquiesce in a scepticism, of

which there is no other example in the wide field of human speculation; he will either make out the insufficiency of the historical evidence, or prove that the falsehood ascribed to Jesus Christ has no existence. He will try to dispose of one of the terms of the alleged contradiction, before he can prevail upon himself to admit both, and deliver his mind to a state of uncertainty most painful to those who respect truth in all her departments.

146. We offer the above observations, not so much for the purpose of doing away a difficulty which we conscientiously believe to have no existence, as for the purpose of exposing the rapid, careless, and unphilosophical procedure of some enemies to the Christian argument. They, in the first instance, take up the rapid assumption, that Jesus Christ has, either through himself, or his immediate disciples, made an assertion as to the antiquity of the globe, which, upon the faith of their geological speculations, they know to be a falsehood. After having fastened this stain upon the subject of the testimony, they, by one summary act of the understanding, lay aside all the external evidence for the miracles and general character of our Saviour. They will not wait to be told, that this evidence is a distinct subject of examination; and that, if actually attended to, it will be found much stronger than the evidence of any other fact or history which has come down to us in the written memorials of past ages. If this evidence is to be rejected, it must be rejected on its own proper grounds; but if all positive testimony, and all sound reasoning upon human affairs, go to establish it, then the existence of such proof is a phenomenon which remains to be accounted for, and must ever stand in the way of positive infidelity. Until we dispose of it, we can carry our opposition to the claims of our religion no farther than to the length of an ambiguous and mid-way scepticism. By adopting a decisive infidelity, we reject a testimony, which, of all others, has come down to us in the most perfect and unsuspicious form. We lock up a source of evidence, which is often repaired to in other questions of science and history. We cut off the authority of principles, which, if once exploded, will not terminate in the solitary mischief of darkening and destroying our theology, but will shed a baleful uncertainty over many of the most interesting speculations on which the human mind can expatiate.

147. Even admitting, then, this single objection in the subject of our Saviour's testimony, the whole length to which we can legitimately carry the objection is scepticism, or that dilemma of the mind into which it is thrown by two contradictory appearances. This is the unavoidable result of admitting both terms in the alleged contradiction. Upon the strength of all the reasoning which has hitherto occupied this article, we challenge the infidel to dispose of the one term which lies in the strength of the historical evidence. But we undertake to dispose of the other which lies in the alleged falsehood of our Saviour's testimony. We will not try to make our escape, by denying the truth of the geological speculation. We are not afraid to own that we are impressed by its evidence, and feel our imagination regaled by its brilliancy. We will not try to do away the supposed falsehood, by asserting what has been called the Mosaical antiquity of the world; but we deny that our Saviour ever asserted this antiquity. It is true that he gives his distinct testimony to the divine legation of Moses; but does Moses ever say, that when God created the heavens and the earth, he did more at the time alluded to than transform them out of previously existing materials? Or does he ever say, that there was not an interval of many ages betwixt the first act of creation, described in the first verse of the book of Genesis, and said to have been performed at the *beginning;* and those more detailed operations, the account of which commences at the second verse, and which are described to us under the allegory of days?—Or does he ever bring forward any literal interpretation of this history which brings him into the slightest contact with the doctrines of geology? Or, finally, does he ever make us to understand, that the genealogies of man went any farther than to fix the antiquity of the species, and, of consequence, that they left the antiquity of the globe a free subject for the speculations of philosophers? The historical evidence remains in all the obstinacy of experimental and well-attested facts; and as there are so many ways of expunging the other term in the alleged contradiction, we appeal to every enlightened reader, if it is at all candid or philosophical to suffer it to stand?

Internal evidence considered.

148. There is another species of evidence for Christianity which we have not yet noticed. What is commonly called the *internal evidence*, or those proofs that Christianity is a dispensation from heaven, founded upon the nature of its doctrines, and the character of the dispensation itself. The term "internal evidence" may be made indeed to take up more than this. We may take up the New Testament as a human composition, and without any reference to its subsequent history, or to the direct and external testimonies by which it is supported. We may collect from the performance itself such marks of truth and honesty, as entitle us to conclude, that the human agents employed in the construction of this book were men of veracity and principle. This argument has already been resorted to, and a very substantial argument it is. It is of frequent application in questions of general criticism; and upon its authority alone many of the writers of past times have been admitted into credit, and many have been condemned as unworthy of it. The numerous and correct allusions to the customs and institutions, and other statistics of the age in which the pieces of the New Testament profess to have been written, give evidence of their antiquity. The artless and undesigned way in which these allusions are interwoven with the whole history, impresses upon us the perfect simplicity of the authors, and the total absence of every wish or intention to palm an imposture upon the world. And there is such a thing too as a general air of authenticity, which, however difficult to resolve into particulars, gives a very close and powerful impression of truth to the narrative. There is nothing fanciful in this species of internal evidence. It carries in it all the certainty of experience, and experience too upon a familiar and well known subject,—the characters of honesty in the written testimony of our fellow men. We are often called upon in private and every-day life to exercise our judgment upon the spoken testimony of others, and we both feel and understand the powerful evidence which lies in the tone, the manner, the circumstantiality, the number, the agreement of the witnesses, and the consistency of all the particulars with what we already know from other sources of information. Now it is undeniable, that all those marks which give evidence and credibility to spoken testimony, may also exist to a very impressive degree in written testimony; and the argument founded upon them, so far from being fanciful or illegitimate, has the sanction of a principle which no philosopher will refuse; the expe-

rience of the human mind on a subject on which it is much exercised, and which lies completely within the range of its observation.

149. We cannot say so much, however, for the other species of internal evidence, that which is founded upon the reasonableness of the doctrines, or the agreement which is conceived to subsist betwixt the nature of the Christian religion and the character of the Supreme Being. We have experience of man, but we have no experience of God. We can reason upon the procedure of man in given circumstances, because this is an accessible subject, and comes under the cognizance of observation; but we cannot reason on the procedure of the Almighty in given circumstances. This is an inaccessible subject, and comes not within the limits of direct and personal observation. The one, like the scale, and compass, and measurements of Sir Isaac Newton, will lead you on safe and firm footing to the true economy of the heavens; the other, like the ether and whirlpools, and unfounded imaginations of Des Cartes, will not only lead you to misconceive that economy, but to maintain a stubborn opposition to the only competent evidence that can be offered upon the subject.

150. The writer of the present article feels, that in thus disclaiming all support from what is commonly understood by the internal evidence, he does not follow the general example of those who have written on the Deistical controversy. Take up Leland's performance, and it will be found, that one half of his discussion is expended upon the reasonableness of the doctrines, and in asserting the validity of the argument which is founded upon that reasonableness. It would save a vast deal of controversy, if it could be proved that all this is superfluous and uncalled for; that upon the authority of the proofs already insisted on, the New Testament must be received as a revelation from heaven; and that, instead of sitting in judgment over it, nothing remains on our part, but an act of unreserved submission to all the doctrine and information which it offers to us. It is conceived, that in this way the general argument might be made to assume a more powerful and impressive aspect; and it is hoped, that the reader will not look upon the article as prolonged to an unnecessary length, if, by unfolding the speculation, the defence of Christianity can be more accommodated to the spirit and philosophy of the times.

151. Since the spirit of Lord Bacon's philosophy began to be rightly understood, the science of external nature has advanced with a rapidity unexampled in the history of all former ages. The great axiom of his philosophy is so simple in its nature, and so undeniable in its evidence, that it is astonishing how philosophers were so late in acknowledging it, or in being directed by its authority. It is more than two thousand years since the phenomena of external nature were objects of liberal curiosity to speculative and intelligent men. Yet two centuries have scarcely elapsed since the true path of investigation has been rightly pursued, and steadily persevered in. Since the evidence of experience has been received as paramount to every other evidence, or, in other words, since philosophers have agreed that the only way to learn the magnitude of an object is to measure it, the only way to learn its tangible properties is to touch it, and the only way to learn its visible properties is to look at it.

152. Nothing can be more safe or more infallible than the procedure of the inductive philosophy as applied to the phenomena of external nature. It is the eye, or the ear-witness of every thing which it records. It is at liberty to classify appearances, but then in the work of classifying, it must be directed only by observation. It may groupe phenomena according to their resemblances. It may express these resemblances in words, and announce them to the world in the form of general laws. Yet such is the hardihood of the inductive philosophy, that though a single well-attested fact should overturn a whole system, that fact must be admitted. A single experiment is often made to cut short the finest process of generalization, however painful and humiliating the sacrifices, and though a theory, the most simple and magnificent that ever charmed the eye of an enthusiast, was on the eve of emerging from it.

153. In submitting, then, to the rules of the inductive philosophy, we do not deny that certain sacrifices must be made, and some of the most urgent propensities of the mind, put under severe restraint and regulation. The human mind feels restless and dissatisfied under the anxieties of ignorance. It longs for the repose of conviction; and to gain this repose, it will often rather precipitate its conclusions, than wait for the tardy lights of observation and experiment. There is such a thing, too, as the love of symplicity and system—a prejudice of the understanding, which disposes it to include all the phenomena of nature under a few sweeping generalities—an indolence, which loves to repose on the beauties of a theory, rather than encounter the fatiguing detail of its evidence—a painful reluctance to the admission of facts, which, however true, break in upon the majestic simplicity that we would fain ascribe to the laws and operations of the universe.

154. Now, it is the glory of Lord Bacon's philosophy, to have achieved a victory over all these delusions—to have disciplined the minds of its votaries into an entire submission to evidence—to have trained them up in a kind of steady coldness to all the splendour and magnificence of theory, and taught them to follow, with an unfaultering step, wherever the sure though humbler path of experiment may lead them.

155. To justify the cautious procedure of the inductive philosophy, nothing more is necessary than to take a view of the actual powers and circumstances of humanity; of the entire ignorance of man, when he comes into the world, and of the steps by which that ignorance is enlightened; of the numerous errors into which he is misled, the moment he ceases to observe, and begins to presume or to excogitate; of the actual history of science; its miserable progress, so long as categories and principles retained their ascendency in the schools; and the splendour and rapidity of its triumphs, so soon as man understood, that he was nothing more than the disciple of Nature, and must take his lesson as Nature offers it to him.

156. What is true of the science of external nature holds equally true of the science and phenomena of mind. On this subject, too, the presumptuous ambition of man carried him far from the sober path of experimental inquiry. He conceived that his business was not to observe, but to speculate; to construct systems rather than consult his own experience, and the experience of others; to collect the materials of his theory, not from the history of observed facts, but from a set of assumed and excogitated principles. Now the same observations apply to this department of inquiry. We must admit to be true not what we presume, but what we find to be so. We must restrain the enterprises of fancy. A law of the human mind must be only a series of well authenticated facts, reduced to one general description, or grouped together under some general points of resemblance. The business of the moral as well as of the

natural philosopher is not to assert what he excogitates, but to record what he observes; not to amuse himself with the speculations of fancy, but to describe phenomena as he sees or as he feels them. This is the business of the moral as well as of the natural enquirer. We must extend the application of Lord Bacon's principles to moral and metaphysical subjects. It was long before this application was recognized, or acted upon by philosophers. Many of the continental speculations are still infected with the presumptuous, *a priori* spirit of the old schools; though the writings of Reid and Stewart have contributed much to chase away this spirit from the metaphysics of our own country, and to bring the science of mind, as well as matter, under the entire dominion of the inductive philosophy.

157. These general observations we conceive to be a most direct and applicable introduction to that part of the subject which is before us. In discussing the evidence of Christianity, all that we ask of our reader is to bring along with him the same sober and inductive spirit, that is now deemed so necessary in the prosecution of the other sciences; to abandon every system of theology, that is not supported by evidence, however much it may gratify his taste, or regulate his imagination, and to admit any system of theology, that is supported by evidence, however repugnant to his feelings or his prejudices; to make conviction, in fact, paramount to inclination, or to fancy; and to maintain, through the whole process of the investigation, that strength and intrepidity of character, which will follow wherever the light of argument may conduct, though it should land him in conclusions the most nauseous and unpalatable.

158. We have no time to enter into causes; but the fact is undeniable. Many philosophers of the present day are disposed to nauseate every thing connected with theology. They associate something low and ignoble with the prosecution of it. They regard it, as not a fit subject for liberal enquiry. They turn away from it with disgust, as one of the humblest departments of literary exertion. We do not say that they reject its evidences, but they evade the investigation of them. They feel no conviction; not because they have established the fallacy of a single argument, but because they entertain a general dislike at the subject, and will not attend to it. They love to expatiate in the more kindred fields of science or elegant literature; and while the most respectful caution, and humility, and steadiness, are seen to preside over every department of moral and physical investigation, theology is the only subject that is suffered to remain the victim of prejudice, and of a contempt the most unjust, and the most unphilosophical.

159. We do not speak of this feeling as an impiety; we speak of it as an offence against the principles of just speculation. We do not speak of it as it allures the heart from the influence of religion; we speak of it as it allures the understanding from the influence of evidence and truth. In a word, we are not preaching against it; we reason against it. We contend that it is a transgression against the rules of the inductive philosophy. All that we want is, the application of Lord Bacon's principles to the investigation before us; and as the influence of prejudice and disgust is banished from every other department of enquiry, we conceive it fair that it should be banished from theology also, and that our subject should have the common advantage of a hearing,—where no partiality of the heart or fancy is admitted, and no other influence acknowledged, than the influence of evidence over the conviction of the understanding.

160. Let us therefore evince the success and felicity with which Lord Bacon's principles may be applied to the investigation before us.

161. According to Bacon, man is ignorant of every thing antecedent to observation, and there is not a single department of enquiry in which he does not err the moment that he abandons it. It is true, that the greater part of every individual's knowledge is derived immediately from testimony; but it is only testimony that brings home to his conviction the observation of others. Still it is observation which lies at the bottom of his knowledge. Still it is man taking his lesson from the actual condition of the thing which he contemplates; a condition that is altogether independent of his will, and which no speculation of his own can modify or destroy. There is an obstinacy in the processes of nature which he cannot controul. He must follow it. The construction of a system should not be a creative, but an imitative process, which admits nothing but what evidence assures us to be true, and is founded only on the lessons of experience. It is not by the exercise of a sublime and speculative ingenuity that man arrives at truth. It is by letting himself down to the drudgery of observation. It is by descending to the sober work of seeing, and feeling, and experimenting. Wherever, in short, he has not had the benefit of his own observation, or the observation of others brought home to his conviction by creditable testimony, there he is ignorant.

162. This is found to hold true, even in those sciences, where the objects of enquiry are the most familiar and the most accessible. Before the right method of philosophising was acted upon, how grossly did philosophers misinterpret the phenomena of external nature! When a steady perseverence in the path of observation could have led them to infallible certainty, how misled in their conception of every thing around them, when, instead of making use of their senses, they delivered themselves up to the exercises of a solitary abstraction, and thought to explain every thing by the fantastic play of unmeaning terms, and imaginary principles! And, when at last set on the right path of discovery, how totally different were the results of actual observation, from those systems which antiquity had rendered venerable, and the authority of great names had recommended to the acquiescence of many centuries! This proves, that, even in the most familiar subjects, man knows every thing by observation, and is ignorant of every thing without it; and that he cannot advance a single footstep in the acquirement of truth, till he bid adieu to the delusions of theory, and sternly refuse indulgence to its fondest anticipations.

163. Thus, there is both a humility and a hardihood in the philosophical temper. They are the same in principle, though different in display. The first is founded on a sense of ignorance, and disposes the mind of the philosopher to pay the most respectful attention to every thing that is offered in the shape of evidence. The second consists in a determined purpose to reject and to sacrifice every thing that offers to oppose the influence of evidence, or to set itself up against its legitimate and well established conclusions. In the ethereal whirlpools of Des Cartes, we see a transgression against the humility of the philosophical character. It is the presumption of knowledge on a subject, where the total want of observation should have confined him to the modesty of ignorance. In the Newtonian system of the world, we see both humility and hardihood. Sir Isaac commences his investigation with all the modesty of a respectful enquirer. His is the docility of a scholar, who is sensible

that he has all to learn. He takes his lesson as experience offers it to him, and yields a passive obedience to the authority of this great school-master. It is in his obstinate adherence to the truth which his master has given him, that the hardihood of the philosophical character begins to appear. We see him announce, with entire confidence, both the fact and its legitimate consequences. We see him not deterred by the singularity of his conclusions, and quite unmindful of that host of antipathies which the reigning taste and philosophy of the times mustered up to oppose him. We see him resisting the influence of every authority, but the authority of experience. We see that the beauty of the old system had no power to charm him from that process of investigation by which he destroyed it. We see him sitting upon its merits with the severity of a judge, unmoved by all those graces of simplicity and magnificence, which the sublime genius of its inventor had thrown around it.

164. We look upon these two constituents of the philosophical temper, as forming the best preparation for finally terminating in the decided Christian. In appretiating the pretensions of Christianity, there is a call both upon the humility and the hardihood of every enquirer; the humility which feels its own ignorance, and submits without reserve to whatever comes before it in the shape of authentic and well-established evidence; and the hardihood, which sacrifices every taste and every prejudice at the shrine of conviction, which defies the scorn of a pretended philosophy, which is not ashamed of a profession that some conceive to be degraded by the homage of the superstitious vulgar, which can bring down its mind to the homeliness of the gospel, and renounce without a sigh all that is elegant, and splendid, and fascinating in the speculations of moralists. In attending to the complexion of the Christian argument, we are widely mistaken, if it is not precisely that kind of argument, which will be most readily admitted by those whose minds have been trained to the soundest habits of philosophical investigation; and if that spirit of cautious and sober-minded enquiry to which modern science stands indebted for all her triumphs, is not the very identical spirit which leads us to "cast down all our lofty imaginations, and to bring every thought into the captivity of the obedience of Christ."

165. On entering into any department of enquiry, the best preparation is that docility of mind which is founded on a sense of our total ignorance of the subject; and nothing is looked upon as more unphilosophical than the temerity of that *a priori* spirit, which disposes many to presume before they investigate. But if we admit the total ignorance of man antecedent to observation, even in those sciences where the objects of enquiry are the nearest and the most familiar, we will be more ready to admit his total ignorance of those subjects which are more remote and more inaccessible. If caution and modesty be esteemed so philosophical, even when employed in that little field of investigation which comes within the range of our senses; why should they not be esteemed philosophical when employed on a subject so vast, so awful, so remote from direct and personal observation, as the government of God? There can be nothing so completely above us, and beyond us, as the plans of the Infinite Mind, which extend to all time, and embrace all worlds. There is no subject to which the cautious and humble spirit of Lord Bacon's philosophy is more applicable; nor can we conceive a more glaring rebellion against the authority of his maxims, than for the beings of a day to sit in judgment upon the Eternal, and apply their paltry experience to the counsels of his high and unfathomable wisdom. We do not speak of it as impious; we speak of it as unphilosophical. We are not bringing the decrees of the orthodox to bear against it; we are bringing the principles of our modern and enlightened schools. We are applying the very same principles to a system of theism, that we would do to a system of geology. Both may regale the fancy with the grandeur of their contemplations; both may receive embellishment from the genius and imagination of their inventors; both may carry us along with the powers of a captivating eloquence. But all this is not enough to satisfy the severe and scrupulous spirit of the modern philosophy. Give us facts. Give us appearances. Show us how, from the experience of a life or a century, you can draw a legitimate conclusion so boundless in its extent, and by which you propose to fix down both the processes of a remote antiquity, and the endless progressions either of nature or of providence in future ages. Are there any historical documents? Any memorials of the experience of past times? On a question of such magnitude we would esteem the recorded observations of some remote ages to be peculiarly valuable, and worth all the ingenuity and eloquence, which a philosopher could bestow on the limited experience of one or two generations. A process of geology may take millions of years before it reaches its accomplishment. It is impossible, that we can collect the law or the character of this process from the experience of a single century, which does not furnish us one single step in this vast and immeasureable progression. We look as far as we can into a distant antiquity, and take hold with avidity of any authentic document, by which we can ascertain a single fact to guide and to enlighten us in this interesting speculation. The same caution is necessary in the subject before us. The administration of the Supreme Being is coeval with the first purposes of his uncreated mind, and it points to eternity. The life of man is but a point in that progress, to which we see no end, and can assign no beginning. We are not able to collect the law or the character of this administration from an experience so momentary. We therefore cast an eye on the history of past times. We examine every document which comes before us. We compare all the moral phenomena, which can be collected from the narrative of antiquity. We seize with avidity every record of the manifestation of Providence, every fact which can enlighten the ways of God to man; and we would esteem it a deviation from the right spirit and temper of philosophical investigation, were we to suffer the crude or fanciful speculations of our own limited experience to take a precedency over the authentic information of history.

166. But this is not all. Our experience is not only limited in point of time; it is also limited in point of extent. To assign the character of the divine administration from the little that offers itself to the notice of our own personal experience, would be far more absurd than to infer the history and character of the kingdom from the history and character of our own families. Vain is the attempt to convey in language what the most powerful imagination sinks under; how small the globe, and all which it inherits, is in the immensity of creation! How humble a corner in the immeasurable fields of nature and of providence! If the whole visible creation were to be swept away, we think of the dark and awful solitude which it would leave behind it in the unpeopled regions of space. But to a mind that could take in the whole, and throw a wide survey over the innumerable worlds which roll beyond the ken of the human eye, there would be no blank, and the universe of

God would appear a scene as goodly and majestic as ever. Now it is the administration of this God that we sit in judgment upon; the counsels of Him, whose wisdom and energy are of a kind so inexplicable; whom no magnitude can overpower, whom no littleness can escape, whom no variety can bewilder; who gives vegetation to every blade of grass, and moves every particle of blood which circulates through the veins of the meanest animal; and all this by the same omnipotent arm that is abroad upon the universe, and presides in high authority over the destiny of all worlds.

167. It is impossible not to mingle the moral impressions of piety with such a contemplation. But suppose these impressions to be excluded, that the whole may be reduced to a matter of abstract and unfeeling intelligence. The question under consideration is, How far the experience of man can lead him to any certain conclusions, as to the character of the divine administration? If it does lead him to some certain conclusions, then, in the spirit of the Baconian philosophy, he will apply these conclusions to the information derived from other sources, and they will of course affect, or destroy, or confirm the credibility of that information. If, on the other hand, it appears that experience gives no light, no direction on the subject, then, in the very same spirit, he will submit his mind as a blank surface to all the positive information which comes to it from any other quarter. We take our lesson as it comes to us, provided we are satisfied beforehand, that it comes from a source which is authentic. We set up no presumptions of our own against the authority of the unquestionable evidence that we have met with, and reject all the suggestions which our defective experience can furnish, as the follies of a rash and fanciful speculation.

168. Now, let it be observed, that the great strength of the Christian argument lies in the historical evidence for the truth of the gospel narrative. In discussing the light of this evidence, we walk by the light of experience. We assign the degree of weight that is due to the testimony of the first Christians upon the observed principles of human nature. We do not step beyond the cautious procedure of Lord Bacon's philosophy. We keep within the safe and certain limits of experimental truth. We believe the testimony of the apostles, because, from what we know of the human character, it is impossible that men in their circumstances could have persevered as they did in the assertion of a falsehood; it is impossible that they could have imposed this falsehood upon such a multitude of followers; it is impossible that they could have escaped detection, surrounded as they were by a host of enemies, so eager and so determined in their resentments. On this kind of argument we are quite at home. There is no theory, no assumption. We feel every inch of the ground we are treading upon. The degree of credit that should be annexed to the testimony of the apostles is altogether a question of experience. Every principle which we apply towards the decision of this question, is founded upon materials which lie before us, and are every day within the reach of observation. Our belief in the testimony of the apostles is founded upon our experience of human nature and human affairs. In the whole process of the inquiry, we never wander from that sure, though humble path, which has been pointed out to us by the great master of philosophising. We never cast off the authority of those maxims, which have been found in every other department of knowledge to be sound and infallible. We never suffer assumption to take the precedency of observation, or abandon that safe and certain mode of investigation, which is the only one suited to the real mediocrity of our powers.

169. It appears to us, that the disciples of the infidel philosophy have reversed this process. They take a loftier flight. You seldom find them upon the ground of the historical evidence. It is not, in general, upon the weight, or the nature of human testimony, that they venture to pronounce on the credibility of the Christian revelation. It is on the character of that revelation itself. It is on what they conceive to be the absurdity of its doctrines. It is because they see something in the nature or dispensation of Christianity, which they think disparaging to the attributes of God, and not agreeable to that line of proceeding which the Almighty should observe in the government of his creatures. Rousseau expresses his astonishment at the strength of the historical testimony; so strong, that the inventor of the narrative appeared to him to be more miraculous than the hero. But the absurdities of this said revelation are sufficient in his mind to bear down the whole weight of its direct and external evidences. There was something in the doctrines of the New Testament repulsive to the taste and the imagination, and perhaps even to the convictions of this interesting enthusiast. He could not reconcile them with his pre-established conceptions of the divine character and mode of operation. To submit to these doctrines, he behoved to surrender that theism, which the powers of his ardent mind had wrought up into a most beautiful and delicious speculation. Such a sacrifice was not to be made. It was too painful. It would have taken away from him, what every mind of genius and sensibility esteems to be the highest of all luxuries. It would destroy a system, which had all that is fair and magnificent to recommend it, and mar the gracefulness of that fine intellectual picture, on which this wonderful man had bestowed all the embellishments of feeling, and fancy, and eloquence.

170. In as far, then, as we can judge of the conduct of man in given circumstances, we would pass a favourable sentence upon the testimony of the apostles. But, says the Deist, I judge of the conduct of God; and what the apostles tell me of him is so opposite to that judgment, that I discredit their testimony. The question at issue betwixt us is, shall we admit the testimony of the apostles, upon the application of principles founded on observation, and as certain as is our experience of human affairs? Or shall we reject that testimony upon the application of principles that are altogether beyond the range of observation, and as doubtful and imperfect in their nature, as is our experience of the counsels of Heaven? In the first argument there is no assumption. We are competent to judge of the behaviour of man in given circumstances. This is a subject completely accessible to observation. The second argument is founded upon assumption entirely. We are not competent to judge of the conduct of the Almighty in given circumstances. Here we are precluded, by the nature of the subject, from the benefit of observation. There is no antecedent experience to guide or to enlighten us. It is not for man to assume what is right, or proper, or natural for the Almighty to do. It is not in the mere spirit of piety that we say so; it is in the spirit of the soundest experimental philosophy. The argument of the Christian is precisely what the maxims of Lord Bacon would dispose us to acquiesce in. The argument of the infidel is precisely that argument which the same maxims would dispose us to reject; and when put by

the side of the Christian argument, it appears as crude and as unphilosophical, as do the ingenious speculations of the schoolmen, when set in opposition to the rigour, and evidence, and precision, which reign in every department of modern science.

171. The application of Lord Bacon's philosophy to the study of external nature was a happy epoch in the history of physical science. It is not long since this application has been extended to the study of moral and intellectual phenomena. All that we contend for is, that our subjects should have the benefit of the same application; and we count it hard, while, in every other department of inquiry, a respect for truth is found sufficient to repress the appetite for system-building; that theology, the loftiest and most inaccessible of all the sciences, should still remain infected with a spirit so exploded, and so unphilosophical; and that the fancy, and theory, and unsupported speculation, so current among the Deists and demi-infidels of the day, should be held paramount to the authority of facts, which have come down to us with a weight of evidence and testimony, that is quite unexampled in the history of ancient times.

172. What is science, but a record of observed phenomena, grouped together according to certain points of resemblance, which have been suggested by an actual attention to the phenomena themselves? We never think of questioning the existence of the phenomena, after we have demonstrated the genuineness and authenticity of the record. After this is demonstrated, the singular or unexpected nature of the phenomena is not suffered to weaken their credibility,—a credibility which can only be destroyed by the authority of our own personal observation, or some other record possessed of equal or superior pretensions. But in none of the inductive sciences is it in the power of a student to verify every thing by his own personal observation. He must put up with the observations of others, brought home to the convictions of his own mind by creditable testimony. In the science of geology, this is eminently the case. In a science of such extent, our principles must be in part founded upon the observations of others, transmitted to us from a distant country. And in a science, the processes of which are so lengthened in point of time, our principles should also in part be founded on the observations of others, transmitted to us from a remote antiquity. Any observations of our own are so limited, both in point of space and of time, that we never think of opposing their authority to the evidence which is laid before us. Our whole attention is directed to the validity of the record; and the moment that this validity is established, we hold it incumbent upon us to submit our minds to the entire and unmodified impression of the testimony contained in it. Now, all that we ask is, that the same process of investigation be observed in theology, which is held to be so sound and so legitimate in other sciences. In a science of such extent, as to embrace the wide domain of moral and intelligent nature, we feel the littleness of that range to which our own personal observations are confined. We shall be glad, not merely of the information transmitted to us from a distant country, but of the authentic information transmitted to us by any other order of beings, in some distant and unknown part of the creation. In a science, too, which has for its object the lengthened processes of the divine administration, we should like if any record of past times could enable us to extend our observations beyond the limits of our own ephemeral experience; and if there are any events of a former age possessed of such a peculiar and decisive character, as would help us to some satisfactory conclusion in this greatest and most interesting of the sciences.

173. On a subject so much above us and beyond us, we would never think of opposing any preconceptions to the evidence of history. We would maintain the humility of the inductive spirit. We would cast about for facts, and events, and appearances. We would offer our minds as a blank surface to every thing that came to them, supported by unexceptionable evidence. It is not upon the nature of the facts themselves, that we would pronounce upon their credibility, but upon the nature of that testimony by which they were supported. Our whole attention would be directed to the authority of the record. After this was established, we would surrender our whole understanding to its contents. We would school down every antipathy within us, and disown it as a childish affection, unworthy of a philosopher who professes to follow truth through all the disgusts and discouragements which surround it. There are men of splendid reputation in our enlightened circles, who never attended to this speculation, and who annex to the gospel of Christ nothing else than ideas of superstition and vulgarity. In braving their contempt, we would feel ourselves in the best element for the display and exercise of the philosophical temper. We would rejoice in the omnipotence of truth, and anticipate, in triumph, the victory which it must accomplish over the pride of science and the fastidiousness of literature. It would not be the enthusiasm of a visionary which would support us, but the inward working of the very same principle which sustained Galileo, when he adhered to the result of his experiments, and Newton, when he opposed his measurements and observations to the tide of prejudice he had to encounter from the prevailing taste and philosophy of the times.

174. We conceive, that inattention to the above principles has led many of the most popular and respected writers in the Deistical controversy to introduce a great deal of discussion that is foreign to the merits of the question altogether; and in this way the attention is often turned away from the point in which the main strength of the argument lies. An infidel, for example, objects against one of the peculiar doctrines of Christianity. To repel the objection, the Christian conceives it necessary to vindicate the reasonableness of that doctrine, and to shew how consistent it is with all those antecedent conceptions which we derived from the light of natural religion. All this we count superfluous. It is imposing an unnecessary task upon ourselves. Enough for us to have established the authority of the Christian revelation upon the ground of its historical evidence. All that remains is to submit our minds to the fair interpretation of Scripture. Yes; but how do you dispose of the objection drawn from the light of natural religion? In precisely the same way that we would dispose of an objection drawn from some speculative system, against the truth of any physical fact that has been well established by observation or testimony. We would disown the system, and oppose the obstinacy of the fact to all the elegance and ingenuity of the speculation.

175. We are sensible that this is not enough to satisfy a numerous class of very sincere and well-disposed Christians. There are many of this description, who, antecedent to the study of the Christian revelation altogether, repose a very strong confidence in the light of natural religion, and think that, upon the mere strength of its evidence, they can often pronounce with a considerable degree of assurance on the character of the divine administration. To such as these something more

is necessary than the external evidences on which Christianity rests. You must reconcile the doctrines of Christianity with those previous conceptions which the light of nature has given them; and a great deal of elaborate argument is often expended in bringing about this accommodation. It is, of course, a work of greater difficulty, to make Christians of this description of people, though, in point of fact, this difficulty has been overcome, in a way the most masterly and decisive, by one of the soundest and most philosophical of our theologians.

176. To another description of Christians, this attempt to reconcile the doctrines of Christianity with the light of natural religion is superfluous. Give them historical evidence for the truth of Christianity, and all that natural religion may have taught them will fly like so many visionary phantoms before the light of its overbearing authority. With them the argument is reduced to a narrower compass. Is the testimony of the apostles and first Christians sufficient to establish the credibility of the facts which are recorded in the New Testament? The question is made to rest exclusively on the character of this testimony, and the circumstances attending it, and no antecedent theology of their own is suffered to mingle with the investigation. If the historical evidence of Christianity is found to be conclusive, they conceive the investigation to be at an end; and that nothing remains on their part, but an act of unconditional submission to all its doctrines.

177. Though it might be proper, in the present state of opinion, to accommodate to both these cases, yet we profess ourselves to belong to the latter description of Christians. We hold by the total insufficiency of natural religion to pronounce upon the intrinsic merits of any revelation, and think that the authority of every revelation rests exclusively upon its external evidences, and upon such marks of honesty in the composition itself as would apply to any human performance. We rest this opinion, not upon any fanatical expression of the ignorance of man, or how sinful it is for a weak and guilty mortal to pronounce upon the counsels of heaven, and the laws of the divine administration; we disown this presumption, not merely because it is sinful, but because we conceive it to be unphilosophical, and precisely analogous to that theorising *a priori* spirit, which the wisdom of Bacon has banished from all the schools of philosophy.

178. For the satisfaction of the first class, we refer them to that argument which has been prosecuted with so much ability and success by Bishop Butler, in his Analogy of Natural and Revealed Religion. It is not so much the object of this author to found any positive argument on the accordancy which subsists between the processes of the divine administration in nature, and the processes ascribed to God by revelation, as to repel the argument founded upon their supposed discordancy. To one of the second class, the argument of Bishop Butler is not called for; but as to one of the first class, we can conceive nothing more calculated to quiet his difficulties. He believes a God, and he must therefore believe the character and existence of God to be reconcileable with all that he observes in the events and phenomena around him. He questions the claims of the New Testament to be a revelation from heaven; because he conceives, that it ascribes a plan and an economy to the Supreme Being, which are unworthy of his character. We offer no positive solution of this difficulty. We profess ourselves to be too little acquainted with the character of God; and that in this little corner of his works, we see not far enough to offer any decision on the merits of a government, which embraces worlds, and reaches eternity. We think we do enough, if we give a sufficiency of external proof for the New Testament being a true and authentic message from heaven; and that therefore nothing remains for us, but to attend and to submit to it. But the argument of Bishop Butler enables us to do still more than this. It enables us to say, that the very thing objected against in Christianity exists in nature; and that therefore the same God who is the author of nature, may be the author of Christianity. We do not say that any positive evidence can be founded upon this analogy. But in as far as it goes to repel the objection, it is triumphant. A man has no right to retain his theism, if he rejects Christianity upon difficulties to which natural religion is equally liable. If Christianity tells us, that the guilt of a father has brought suffering and vice upon his posterity, it is what we see exemplified in a thousand instances amongst the families around us. If it tells us, that the innocent have suffered for the guilty, it is nothing more than what all history and all observation have made perfectly familiar to us. If it tells us of one portion of the human race being distinguished by the sovereign will of the Almighty for superior knowledge, or superior privileges, it only adds one inequality more to the many inequalities which we perceive every day in the gifts of nature, of fortune, and of providence. In short, without entering into all the details of that argument, which Butler has brought forward in a way so masterly and decisive, there is not a single impeachment which can be offered against the God of Christianity, that may not, if consistently proceeded upon, be offered against the God of Nature itself; if the one be unworthy of God, the other is equally so; and if, in spite of these difficulties, you still retain the conviction, that there is a God of Nature, it is not fair or rational to suffer them to outweigh all that positive evidence and testimony, which have been adduced for proving that the same God is the God of Christianity also.

179. If Christianity be still resisted, it appears to us that the only consistent refuge is Atheism. The very same peculiarities in the dispensation of the gospel, which lead the infidel to reject it as unworthy of God, go to prove, that nature is unworthy of him, and land us in the melancholy conclusion, that whatever theory can be offered as to the mysterious origin and existence of the things which be, they are not under the dominion of a supreme and intelligent mind. Nor do we look upon Atheism as a more hopeless species of infidelity than Deism, unless in so far as it proves a more stubborn disposition of the heart to resist every religious conviction. Viewed purely as an intellectual subject, we look upon the mind of an Atheist, as in a better state of preparation for the proofs of Christianity than the mind of a Deist. The one is a blank surface, on which evidence may make a fair impression, and where the finger of history may inscribe its credible and well-attested information. The other is occupied with pre-conceptions. It will not take what history offers to it. It puts itself into the same unphilosophical posture, in which the mind of a prejudiced Cartesian opposed its theory of the heavens to the demonstration and measurements of Newton. The theory of the Deist upon a subject, where truth is still more inaccessible, and speculation still more presumptuous, sets him to resist the only safe and competent evidence that can be appealed to. What was originally the evidence of observation, and is now transformed into the evidence of testimony, comes down to us in a series of historical documents, the closest and most consistent that all antiqui-

ty can furnish. It is the unfortunate theory which forms the grand obstacle to the admission of the Christian miracles, and which leads the Deist to an exhibition of himself so unphilosophical, as that of trampling on the soundest laws of evidence, by bringing an historical fact under the tribunal of a theoretical principle. The deistical speculation of Rousseau, by which he neutralised the testimony of the first Christians, is as complete a transgression against the temper and principles of true science, as a category of Aristotle when employed to overrule an experiment in chemistry. But however this be, it is evident, that Rousseau would have given a readier reception to the gospel history, had his mind not been preoccupied with the speculation; and the negative state of Atheism would have been more favourable to the admission of those facts, which are connected with the origin and establishment of our religion in the world.

180. This suggests the way in which the evidence for Christianity should be carried home to the mind of an Atheist. He sees nothing in the phenomena around him, that can warrant him to believe in the existence of a living and intelligent principle, which gave birth and movement to all things. He does not say that he would refuse credit to the existence of God upon sufficient evidence, but he says, that there are not such appearances of design in nature, as to supply him with that evidence. He does not deny the existence of God to be a possible truth; but he affirms, that while there is nothing before him but the consciousness of what passes within, and the observation of what passes without, it remains an assertion destitute of proof, and can have no more effect upon his conviction than any other nonentity of the imagination. There is a mighty difference between *not proven* and *disproven*. We see nothing in the argument of the Atheists which goes farther, than to establish the former sentence upon the question of God's existence. It is altogether an argument *ab ignorantia*; and the same ignorance which restrains them from asserting in positive terms that God exists, equally restrains them from asserting in positive terms that God does not exist. The assertion may be offered, that, in some distant regions of the creation, there are tracts of space which, instead of being occupied like the tracts around us with suns and planetary systems, teem only with animated beings, who, without being supported like us on the firm surface of a world, have the power of spontaneous movements in free spaces. We cannot say that the assertion is not true, but we can say that it is not proven. It carries in it no positive character either of truth or falsehood, and may therefore be admitted on appropriate and satisfying evidence. But till that evidence comes, the mind is in a state entirely neutral; and such we conceive to be the neutral state of the Atheist, as to what he holds to be the unproved assertion of the existence of God.

181. To the neutral mind of the Atheist then, unfurnished as it is with any previous conception, we offer the historical evidence of Christianity. We do not ask him to presume the existence of God. We ask him to examine the miracles of the New Testament merely as recorded events, and to admit no other principle into the investigation, than those which are held to be satisfying and decisive, on any other subject of written testimony. The sweeping principle upon which Rousseau, filled with his own assumptions, condemned the historical evidence for the truth of the gospel narrative, can have no influence on the blank and unoccupied mind of an Atheist. He has no presumptions upon the subject; for to his eye the phenomena of nature sit so loose and unconnected with that intelligent Being, to whom they have been referred as their origin, that he does not feel himself entitled, from these phenomena, to ascribe any existence, any character, any attributes, or any method of administration to such a Being. He is therefore in the last possible condition for submitting his understanding to the entire impression of the historical evidence. These difficulties which perplex the Deists, who cannot recognize in the God of the New Testament the same features and the same principles in which they have invested the God of Nature, are no difficulties to him. He has no God of Nature to confront with that real though invisible power which lay at the bottom of those astonishing miracles, on which history has stamped her most authentic characters. Though the power which presided there should be an arbitrary, an unjust, or a malignant being, all this may startle a Deist, but it will not prevent a consistent Atheist from acquiescing in any legitimate inference, to which the miracles of the gospel, viewed in the simple light of historical facts, may chance to carry him. He cannot bring his antecedent information into play upon this question. He professes to have no antecedent information on the subject; and this sense of his entire ignorance, which lies at the bottom of his Atheism, would expunge from his mind all that is theoretical, and make it the passive recipient of every thing which observation offers to its notice, or which credible testimony has brought down to it of the history of past ages.

182. What then, we ask, does the Atheist make of the miracles of the New Testament? If he questions their truth, he must do it upon grounds that are purely historical. He is precluded from every other ground by the very principle on which he has rested his Atheism; and we therefore, upon the strength of that testimony which has been already exhibited, press the admission of these miracles as facts. If there be nothing then, in the ordinary phenomena of nature, to infer a God, do these extraordinary phenomena supply him with no argument? Does a voice from heaven make no impression upon him? And we have the best evidence which history can furnish, that such a voice was uttered; "This is my beloved Son, in whom I am well pleased." We have the evidence of a fact, for the existence of that very Being from whom the voice proceeded, and the evidence of a thousand facts, a power superior to nature; because, on the impulse of a volition, it did counteract her laws and processes, it allayed the wind, it gave sight to the blind, health to the diseased, and, at the utterance of a voice, it gave life to the dead. The ostensible agent in all these wonderful proceedings are not only credentials of his power, but he gave such credentials of his honesty, as dispose our understanding to receive his explanation of them. We do not avail ourselves of any other principle than what an Atheist will acknowledge. He understands as well as we do, the natural signs of veracity, which lie in the tone, the manner, the countenance, the high moral expression of worth and benevolence, and, above all, in that firm and undaunted constancy, which neither contempt, nor poverty, nor death, could shift from any of its positions. All these claims upon our belief, were accumulated to an unexampled degree in the person of Jesus of Nazareth; and when we couple with them his undoubted miracles, and the manner in which his own personal appearance was followed up by a host of witnesses, who, after a catastrophe which would have proved a death-blow to any cause of imposture, offered themselves to the eye of the public, with the same powers, the same evidence, and the same testimony, it seems impossible to resist his account of the invisible principle, which gave birth and movement to the whole of this wonderful transaction. Whatever

Atheism we may have founded on the common phenomena around us, here is a new phenomenon which demands our attention, the testimony of a man who, in addition to evidence of honesty, more varied and more satisfying than were ever offered by a brother of the species, had a voice from the clouds, and the power of working miracles, to vouch for him. We do not think, that the account which this man gives of himself can be viewed either with indifference or distrust, and the account is most satisfying. “I proceeded forth, and came from God.” “He whom God hath sent speaketh the words of God.” “Even as the Father said unto me so I speak.” He had elsewhere said, that God was his Father. The existence of God is there laid before us, by an evidence altogether distinct from the natural argument of the schools, and it may therefore be admitted in spite of the deficiency of that argument. From the same pure and unquestionable source we gather our information of his attributes. “God is true.” “God is a spirit.” He is omnipotent, “for with God all things are possible.” He is intelligent, “for he knoweth what things we have need of.” He sees all things, and he directs all things, for “the very hairs of our head are numbered,” and “a sparrow falleth not to the ground without his permission.”

182. The evidences of the Christian religion are suited to every species of infidelity. We do not ask the Atheist to furnish himself with any previous conception. We ask him to come as he is, and, upon the strength of his own favourite principle, viewing it as a pure intellectual question, and abstracting from the more unmanageable tendencies of the heart and temper. We conceive his understanding to be in a high state of preparation, for taking in Christianity in a fair, purer, and more scriptural form, than can be expected from those whose minds are tainted and pre-occupied with their former speculations.

183. The remainder of this article shall be devoted to the illustration of a very plain but a very important proposition, viz. That, after having established the New Testament to be a message from God, it behoves us to make an entire and unconditional surrender of our minds, to all the duty and to all the information which it sets before us.

184. There is, perhaps, nothing more thoroughly beyond the cognizance of the human faculties, than the truths of religion and the ways of that mighty and invisible Being who is the object of it; and yet nothing, we will venture to say, has been made the subject of more hardy and adventurous speculation. We make no allusion at present to Deists, who reject the authority of the New Testament, because the plan and the dispensation of the Almighty, which is recorded there, is different from that plan and that dispensation which they have chosen to ascribe to him. We speak of Christians, who profess to admit the authority of this record, but who have tainted the purity of their profession by not acting upon its exclusive authority, who have mingled their own thoughts and their own fancy with its information; who, instead of repairing in every question, and in every difficulty, to the principle of “What readest thou,” have abridged the sovereignty of this principle, by appealing to others, of which we undertake to make out the incompetency; who, in addition to the word of God, talk also of the reason of the thing; or the standard of orthodoxy, and have in fact brought down the Bible from the high place which belongs to it, as the only tribunal to which the appeal should be made, or from which the decision should be looked for.

185. But it is not merely among partizans or the advocates of a system, that we meet with this indifference to the authority of what is written. It lies at the bottom of a great deal of that looseness, both in practice and speculation, which we meet with every day in society, and which we often hear expressed in familiar conversation. Whence that list of maxims which are so indolently conceived, but which, at the same time, are so faithfully proceeded upon? “We have all our passions and infirmities; but we have honest hearts, and that will make up for them. Men are not all cast in the same mould. God will not call us to task too rigidly for our foibles, at least this is our opinion; and God can never be so unmerciful, or so unjust, as bring us to a severe and unforgiving tribunal for the mistakes of the understanding.” Now, it is not licentiousness in general, which we are speaking against. It is against that sanction which it appears to derive from the self-formed maxims of him who is guilty of it. It is against the principle that either an error of doctrine, or an indulgence of passion is to be exempted from condemnation, because it has an opinion of the mind to give it countenance and authority. What we complain of is, that a man no sooner sets himself forward and says, “this is my sentiment,” than he conceives that all culpability is taken away from the error, either of practice or speculation, into which he has fallen; the carelessness with which the opinion has been formed, is of no account in the estimate. It is the mere existence of the opinion, which is plead in vindication, and under the authority of *our maxim*, and *our mode of thinking*, every man conceives himself to have a right to his own way and his own peculiarity.

186. Now this might be all very fair, were there no Bible and no revelation in existence. But it is not fair, that all this looseness, and all this variety, should be still floating in the world, in the face of an authoritative communication from God himself. Had no message come to us from the fountain-head of truth, it were natural enough for every individual mind to betake itself to its own speculation. But a message has come to us, bearing on its forehead every character of authenticity, and is it right now, that the question of our faith, or of our duty, should be committed to the capricious variations of this man's taste or of that man's fancy? Our maxim, and our sentiment! God has put an authoritative stop to all this. He has spoken, and the right or the liberty of speculation no longer remains to us. The question now is, not “What thinkest thou?” In the days of Pagan antiquity, no other question could be put, and the wretched delusions and idolatries of that period let us see what kind of answer the human mind is capable of making, when left to its own guidance, and its own authority. But we call ourselves Christians, and profess to receive the Bible as the directory of our faith, and the only question in which we are concerned, is, “What is written in the law? how readest thou?”

187. But there is a way of escaping from this conclusion. No man calling himself a Christian, will ever disown in words the authority of the Bible. Whatever be counted the genuine interpretation, it must be submitted to. But in the act of coming to this interpretation, it will be observed, there is room for the unwarrantable principles which we are attempting to expose. The business of a scripture critic is to give a fair representation of the sense of all its passages as they exist in the original. Now, this is a process which requires some investigation, and it is during the time that this process is carrying on, that the tendencies and antecedent opinions of the mind are suffered to mislead the enquirer from the true principles of the business in which he is employed.

The mind and meaning of the author, who is translated, is purely a question of language, and should be decided upon no other principles than those of grammar or philology. Now, what we complain of is, that while this principle is recognised and acted upon in every other composition which has come down to us from antiquity, it has been most glaringly departed from in the case of the Bible; that the meaning of its author, instead of being made singly and entirely a question of grammar, has been made a question of metaphysics, or a question of sentiment; that instead of the argument resorted to being, such must be the rendering from the structure of the language, and the import and significancy of its phrases, it has been, such must be the rendering from the analogy of the faith, the reason of the thing, the character of the Divine mind, and the wisdom of all his dispensations. And whether this argument be formally insisted upon or not, we have still to complain, that in reality it has a most decided influence on the understanding of many a Christian; and in this way, the creed which exists in his mind, instead of being a fair transcript of the New Testament, is the result of a compromise which has been made betwixt its authoritative decisions and the speculations of his own fancy.

188. What is the reason why there is so much more unanimity among critics and grammarians about the sense of any ancient author, than about the sense of the New Testament. Because the one is made purely a question of criticism: The other has been complicated with the uncertain fancies of a daring and presumptous theology. Could we only dismiss these fancies, sit down like a school-boy to his task, and look upon the study of divinity as a mere work of translation, then we would expect the same unanimity among Christians that we meet with among scholars and literati about the system of Epicurus or philosophy of Aristotle. But here lies the distinction betwixt the two cases. When we make out, by a critical examination of the Greek of Aristotle, that such was his meaning, and such his philosophy, the result carries no authority with it, and our mind retains the congenial liberty of its own speculations. But if we make out, by a critical examination of the Greek of St Paul, that such is the theology of the New Testament, we are bound to submit to this theology; and our minds must surrender every opinion, however dear to them. It is quite in vain to talk of the mysteriousness of the subject, as being the cause of the want of unanimity among Christians. It may be mysterious, in reference to our former conceptions. It may be mysterious in the utter impossibility of reconciling it with our own assumed fancies, and self-formed principles. It may be mysterious in the difficulty which we feel in comprehending the manner of the doctrine, when we ought to be satisfied with the authoritative revelation which has been made to us of its existence and its truth. But if we could only abandon all our former conceptions, if we felt that our business was to submit to the oracle of God, and that we are not called upon to effect a reconciliation betwixt a revealed doctrine of the Bible, and an assumed or excogitated principle of our own;—then we are satisfied, that we would find the language of the Testament to have as much clear, and precise, and distinctive simplicity, as the language of any sage or philosopher that has come down to our time.

189. Could we only get it reduced to a mere question of language, we should look at no distant period for the establishment of a pure and unanimous Christianity in the world. But, no. While the mind and the reasoning of any philosopher is collected from his words, and these words tried as to their import and significancy upon the appropriate principles of criticism, the mind and the reasoning of the spirit of God is not collected upon the same pure and competent principles of investigation. In order to know the mind of the Spirit, the communications of the Spirit, and the expression of these communications in written language, should be consulted. These are the only data upon which the enquiry should be instituted. But, no. Intead of learning the designs and character of the Almighty from his own mouth, we sit in judgment upon them, and make our conjecture of what they should be, take the precedency of his revelations what they are. We do Him the same injustice that we do to an acquaintance, whose proceedings and whose intentions we venture to pronounce upon, while we refuse him a hearing, or turn away from the letter in which he explains himself. No wonder, then, at the want of unanimity among Christians, so long as the question of "what thinkest thou?" is made the principle of their creed, and, for the sake of criticism, they have committed themselves to the endless caprices of the human intellect. Let the principle of "what thinkest thou" be exploded, and that of "what readest thou" be substituted in its place. Let us take our lesson as the Almighty places it before us, and, instead of being the judge of his conduct, be satisfied with the safer and humbler office of being the interpreter of his language.

190. Now this principle is not exclusively applicable to the learned. The great bulk of Christians have no access to the Bible in its original languages; but they have access to the common translation, and they may be satisfied by the concurrent testimony of the learned among the different sectaries of this country, that the translation is a good one. We do not confine the principle to critics and translators, we press it upon all. We call upon them not to form their divinity by independent thinking, but to receive it by obedient reading, to take the words as they stand, and submit to the plain English of the scriptures which lie before them. It is the office of a translator to give a faithful representation of the original. Now that this faithful representation has been given, it is our part to peruse it with care, and to take a fair and a faithful impression of it. It is our part to purify our understanding of all its previous conceptions. We must bring a free and unoccupied mind to the exercise. It must not be the pride or the obstinacy of self formed opinions, or the haughty independence of him, who thinks he has reached the manhood of his understanding. We must bring with us the docility of a child, if we want to gain the kingdom of heaven. It must not be a partial but an entire and unexpected obedience, There must be no garbling of that which is entire, no darkening of that which is luminous, no softening down of that which is authoritative or severe. The Bible will allow of no compromise. It professes to be the directory of our faith, and claims a total ascendency over the souls and the understandings of men. It will enter into no composition with us or our natural principles. It challenges the whole mind as its due, and it appeals to the truth of heaven for the high authority of its sanctions. "Whosoever addeth to, or taketh from, the words of this book, is accursed," is the absolute language in which it delivers itself. This brings us to its terms. There is no way of escaping after this. We must bring every thought into the captivity of its obedience, and, as closely as ever lawyer stuck to his document or his extracts, must we abide by the rule and the doctrine which this authentic memorial of God sets before us.

191. Now we hazard the assertion, that, with a number of professing Christians, there is not this unexcepted submission of the understanding to the authority of the Bible; and that the authority of the Bible is often modified, and in some cases superseded by the authority of other principles. One of these principles is the reason of the thing. We do not know if this principle would be at all felt or appealed to by the earliest Christians. They turned from dumb idols to serve the living and the true God. There was nothing in their antecedent theology which they could have any respect for: Nothing which they could confront, or bring into competition with the doctrines of the New Testament. In these days, the truth as it is in Jesus came to the mind of its disciples, recommended by its novelty, by its grandeur, by the power and recency of its evidences, and above all by its vast and evident superiority over the fooleries of a degrading Paganism. It does not occur to us, that men in these circumstances would ever think of sitting in judgment over the mysteries of that sublime faith which had charmed them into an abandonment of their earlier religion. It rather strikes us, that they would receive them passively; that, like scholars who had all to learn, they would take their lesson as they found it; that the information of their teachers would be enough for them; and that the restless tendency of the human mind to speculation, would for a time find ample enjoyment in the rich and splendid discoveries, which broke like a flood of light upon the world. But we are in different circumstances. To us, these discoveries, rich and splendid as they are, have lost the freshness of novelty. The sun of righteousness, like the sun in the firmament, has become familiarized to us by possession. In a few ages, the human mind deserted its guidance, and rambled as much as ever in quest of new speculations. It is true, that they took a juster and a loftier flight since the days of Heathenism. But it was only because they walked in the light of revelation. They borrowed of the New Testament without acknowledgment, and took its beauties and its truths to deck their own wretched fancies and self-constituted systems. In the process of time, the delusion multiplied and extended. Schools were formed, and the way of the Divinity was as confidently theorized upon, as the processes of chemistry, or the economy of the heavens. Universities were endowed, and natural theology took its place in the circle of the sciences. Folios were written, and the respected luminaries of a former age poured their *à priori* and their *à posteriori* demonstrations on the world. Taste, and sentiment, and imagination, grew apace; and every raw untutored principle which poetry could clothe in prettiness, or over which the hand of genius could throw the graces of sensibility and elegance, was erected into a principle of the divine government, and made to preside over the councils of the deity. In the mean time, the Bible, which ought to supersede all, was itself superseded. It was quite in vain to say that it was the only authentic record of an actual embassy which God had sent into the world. It was quite in vain to plead its testimonies, its miracles, and the unquestionable fulfilment of its prophecies. These mighty claims must be over, and be suspended, till we have settled—what? The reasonableness of its doctrines. We must bring the theology of God's ambassador to the bar of our self-formed theology. The Bible, instead of being admitted as the directory of our faith upon its external evidences, must be tried upon the merits of the work itself; and if our verdict be favourable, it must be brought in, not as a help to our ignorance, but as a corollary to our demonstrations. But is this ever done? Yes! by Dr Samuel Clarke, and a whole host of followers and admirers. Their first step in the process of theological study, is to furnish their minds with the principles of natural theology. Christianity, before its external proofs are looked at or listened to, must be brought under the tribunal of those principles. All the difficulties which attach to the reason of the thing, or the fitness of the doctrines, must be formally discussed, and satisfactorily got over. A voice was heard from heaven, saying of Jesus Christ, "This is my beloved Son, hear ye him." The men of Galilee saw him ascend from the dead to the heaven which he now occupies. The men of Galilee gave their testimony; and it is a testimony which stood the fiery trial of persecution in a former age, and of sophistry in this. And yet, instead of hearing Jesus Christ as disciples, they sit in authority over him as judges. Instead of forming their divinity after the Bible, they try the Bible by their antecedent divinity; and this book, with all its mighty train of evidences, must drivel in their antichambers, till they have pronounced sentence of admission, when they have got its doctrines to agree with their own airy and unsubstantial speculations.

192. We do not condemn the exercise of reason in matters of theology. It is the part of reason to form its conclusions, when it has data and evidences before it. But it is equally the part of reason to abstain from its conclusions when these evidences are wanting. Reason can judge of the external evidences for Christianity, because it can discern the merits of human testimony; and it can perceive the truth or the falsehood of such obvious credentials in the performance of a miracle, or the fulfilment of a prophecy. But reason is not entitled to sit in judgment over these internal evidences, which many a presumptuous theologian has attempted to derive from the reason of the thing, or from the agreement of the doctrine with the fancied character and attributes of the Deity. One of the most useful exercises of reason, is to ascertain its limits, and to keep within them; to abandon the field of conjecture, and to restrain itself within that safe and certain barrier which forms the boundary of human experience. However humiliating you may conceive it, it is this that lies at the bottom of Lord Bacon's philosophy, and it is to this that modern science is indebted for all her solidity and all her triumphs. Why does philosophy flourish in our days? Because her votaries have learned to abandon their own creative speculations, and to submit to evidences, let her conclusions be as painful and as unpalatable as they will. Now all that we want, is to carry the same lesson and the same principle to theology. Our business is not to guess, but to learn. After we have established Christianity to be an authentic message from God upon these historical grounds,—when the reason and experience of man entitle him to form his conclusions,—nothing remains for us, but an unconditional surrender of the mind to the subject of the message. We have a right to sit in judgment over the credentials of heaven's ambassador, but we have no right to sit in judgment over the information he gives us. We have no right either to refine or to modify that information, till we have accommodated it to our previous conceptions. It is very true, that if the truths which he delivered lay within the field of human observation, he brings himself under the tribunal of our antecedent knowledge. Were he to tell us, that the bodies of the planetary system moved in orbits which are purely circular, we would oppose to him the observations and measurements of astronomy. Were he to tell us, that in winter the sun never shone, and that in summer no

cloud ever darkened the brilliancy of his career, we would oppose to him the certain remembrances, both of ourselves and of our whole neighbourhood. Were he to tell us, that we were perfect men, because we were free from passion, and loved our neighbours as ourselves, we would oppose to him the history of our own lives, and the deeply-seated consciousness of our own infirmities. On all these subjects, we can confront him; but when he brings truth from a quarter which no human eye ever explored; when he tells us the mind of the Deity, and brings before us the counsels of that invisible Being, whose arm is abroad upon all nations, and whose views reach to eternity, he is beyond the ken of eye or of telescope, and we must submit to him. We have no more right to sit in judgment over his information, than we have to sit in judgment over the information of any other visitor who lights upon our planet, from some distant and unknown part of the universe, and tells us what worlds roll in these remote tracts which are beyond the limits of our astronomy, and how the Divinity peoples them with his wonders. Any previous conception of ours are of no more value than the fooleries of an infant; and should we offer to resist or modify upon the strength of our conceptions, we would be as unsound and as unphilosophical as ever schoolman was with his categories, or Cartesian with his whirlpools of ether.

193. Let us go back to the first Christians of the Gentile world. They turned from dumb idols to serve the living and the true God. They made a simple and entire transition from a state as bad, if not worse, than that of entire ignorance, to the Christianity of the New Testament. Their previous conceptions, instead of helping them, behoved to be utterly abandoned; nor was there that intermediate step which so many of us think to be necessary, and which we dignify with the name of the rational theology of nature. In these days, this rational theology was unheard of; nor have we the slightest reason to believe that they were ever initiated into its doctrines, before they were looked upon as fit to be taught the peculiarities of the gospel. They were translated at once from the absurdities of Paganism to that Christianity which has come down to us, in the records of evangelical history, and the epistles which their teachers addressed to them. They saw the miracles; they acquiesced in them, as satisfying credentials of an inspired teacher; they took the whole of their religion from his mouth; their faith came by hearing, and hearing by the words of a divine messenger. This was their process, and it ought to be ours. We do not see the miracles, but we see their reality through the medium of that clear and unsuspicious testimony which has been handed down to us. We should admit them as the credentials of an embassy from God. We should take the whole of our religion from the records of this embassy; and, renouncing the idolatry of our own self-formed conceptions, we should repair to that word, which was spoken to them that heard it, and transmitted to us by the instrumentality of written language. The question with them was, What hearest thou? The question with us is, What readest thou? They had their idols, and they turned away from them. We have our fancies, and we contend, that, in the face of an authoritative revelation from heaven, it is as glaring idolatry in us to adhere to these, as it would be were they spread out upon canvass, or chiselled into material form by the hands of a statuary.

194. In the popular religions of antiquity, we see scarcely the vestige of a resemblance to that academical theism which is delivered in our schools, and figures away in the speculations of our moralists. The process of conversion among the first Christians was a very simple one. It consisted of an utter abandonment of their heathenism, and an entire submission to those new truths which came to them through the revelation of the gospel, and through it only. It was the pure theology of Christ and of his Apostles. That theology which struts in fancied demonstration from a professor's chair, formed no part of it. They listened as if they had all to learn: we listen as if it was our office to judge, and to give the message of God its due place and subordination among the principles which we had previously established. Now these principles were utterly unknown at the first publication of Christianity. The Galatians, and Corinthians, and Thessalonians, and Philippians, had no conception of them. And yet, will any man say, that either Paul himself, or those who lived under his immediate tuition, had not enough to make them accomplished Christians, or that they fell short of our enlightened selves, in the wisdom which prepares for eternity, because they wanted our rational theology as a stepping-stone to that knowledge which came, in pure and immediate revelation, from the Son of God. The gospel was enough for them, and it should be enough for us also. Every natural or assumed principle which offers to abridge its supremacy, or even so much as to share with it in authority and direction, should be instantly discarded. Every opinion in religion should be reduced to the question of—what readest thou? and the Bible be acquiesced in, and submitted to, as the alone directory of our faith, where we can get the whole will of God for the salvation of men.

195. But is not this an enlightened age; and, since the days of the gospel, has not the wisdom of two thousand years accumulated upon the present generation? has not science been enriched by discovery? and is not theology one of the sciences? Are the men of this advanced period to be restrained from the high exercise of their powers? and, because the men of a remote and barbarous antiquity lisped and drivelled in the infancy of their acquirements, is that any reason why we should be restricted like so many school-boys to the lesson that is set before us? It is all true that this is a very enlightened age, but on what field has it acquired so flattering a distinction? On the field of experiment. The human mind owes all its progress to the confinement of its efforts within the safe and certain limits of observation, and to the severe restraint which it has imposed upon its speculative tendencies. Go beyond these limits, and the human mind has not advanced a single inch by its own independent exercises. All the philosophy which has been reared by the labour of successive ages, is the philosophy of facts reduced to general laws, or brought under a general description from observed points of resemblance. A proud and a wonderful fabric we do allow; but we throw away the very instrument by which it was built the moment that we cease to observe, and begin to theorize and excogitate. Tell us a single discovery, which has thrown a particle of light on the details of the divine administration. Tell us a single truth in the whole field of experimental science, which can bring us to the moral government of the Almighty by any other road than his own revelation. Astronomy has taken millions of suns and of systems within its ample domain; but the ways of God to man stand at a distance as inaccessible as ever. Nor has it shed so much as a glimmering over the councils of that mighty and invisible Being, who sits in high authority over all worlds. The boasted discoveries of modern science are all confined to that field, within which the sense of man can expatiate. The moment we go beyond this field they cease to be discoveries, and

are the mere speculations of the fancy. The discoveries of modern science have, in fact, imparted a new energy to the sentiment in question. They all serve to exalt the Deity, but they do not contribute a single iota to the explanation of his purposes. They make him greater, but they do not make him more comprehensible. He is more shrouded in mystery than ever. It is not himself whom we see, it is his workmanship; and every new addition to its grandeur or to its variety which philosophy opens to our contemplation, throws our understanding at a greater distance than before, from the mind and conception of the sublime Architect. Instead of the God of a single world, we now see him presiding in all the majesty of his high attributes, over a mighty range of innumerable systems. To our little eye he is wrapt in more awful mysteriousness, and every new glimpse which astronomy gives us of the universe, justifies, to the apprehension of our mind, that impassable barrier which stands between the counsels of its Sovereign, and those fugitive beings who strut their evanescent hour in the humblest of its mansions. If this invisible Being would only break that mysterious silence in which he has wrapt himself, we feel that a single word from his mouth would be worth a world of darkling speculations. Every new triumph which the mind of man achieves in the field of discovery, binds us more firmly to our Bible; and by the very proportion in which philosophy multiplies the wonders of God, do we prize that book, in which the evidence of history has stamped the character of his authentic communication.

196. The course of the moon in the heavens has exercised astronomers for a long series of ages, and now that they are able to assign all the irregularities of its periods, it may be counted one of the most signal triumphs of modern science. The question lay within the limits of the field of observation. It was accessible to measurement, and, upon the sure principles of calculation, men of science have brought forward the confident solution of a problem, the most difficult and trying that ever was submitted to the human intellect. But let it never be forgotten, that those very maxims of philosophy which guided them so surely and so triumphantly within the field of observation, also restrained them from stepping beyond it, and though none were more confident than they whenever they had evidence and experiment to enlighten them, yet none were more scrupulous in abstaining to pronounce upon any subject, where evidence and experiment were wanting. Let us suppose that one of their number, flushed with the triumph of success, passed on from the work of calculating the periods of the moon, to theorise upon its chemical constitution; the former question lies within the field of observation, the other is most thoroughly beyond it; and there is not a man, whose mind is disciplined to the rigour and sobriety of modern science, that would not look upon the theory with the same contempt, as if it were the dream of a poet, or the amusement of a schoolboy. We have heard much of the moon, and of the volcanoes which blaze upon its surface. Let us have incontestible evidence, that a falling stone proceeds from the eruption of one of these volcanoes, and the chemistry of the moon will receive more illustration from the analysis of that stone, than from all the speculations of all the theorists. It brings the question in part within the limits of observation. It soon becomes a fair subject for the exercise of the true philosophy. The eye can now see, and the hand can now handle it; and the information furnished by the laborious drudgery of experimental men, will be received as a truer document, than the theory of any philosopher, however ingenious, or however splendid.

197. At the hazard of being counted whimsical, we bring forward the above as a competent illustration of the principle which we are attempting to establish. We do all homage to modern science, nor do we dispute the loftiness of its pretensions. But we maintain, that however brilliant its career in those tracts of philosophy, where it has the light of observation to conduct it, the philosophy of all that lies without the field of observation is as obscure and inaccessible as ever. We maintain, that to pass from the motions of the moon to an unauthorized speculation upon the chemistry of its materials, is a presumption disowned by philosophy. We ought to feel, that it would be a still more glaring transgression of all its maxims, to pass from the brightest discovery in the catalogue, to the ways of that mysterious Being, whom no eye hath seen, and whose mind is capacious as infinity. The splendour and the magnitude of what we do know, can never authorise us to pronounce upon what we do not know; nor can we conceive a transition more ardent or more insurmountable, than to pass from the truths of natural science to a speculation on the details of God's administration, or the economy of his moral government. We hear much of revelations from heaven. Let any one of these bear the evidence of an actual communication from God himself, and all the reasonings of all the theologians must vanish, and give place to the substance of this communication. Instead of theorising upon the nature and properties of that divine light which irradiates the throne of God, and exists at so immeasurable a distance from our faculties, let us point our eyes to that emanation, which has actually come down to us. Instead of theorising upon the councils of the divine mind, let us go to that volume which lighted upon our world nearly two thousand years ago, and which bears the most authentic evidence, that it is the depository of part of these councils. Let us apply the proper instrument to this examination. Let us never conceive it to be a work of speculation or fancy. It is a pure work of grammatical analysis. It is an unmixed question of language. The commentator who opens this book with the one hand, and carries his system in the other, has nothing to do with it. We admit of no other instrument than the vocabulary and the lexicon. The man whom we look to is the scripture critic, who can appeal to his authorities for the import and significancy of phrases, and whatever be the strict result of his patient and profound philology, we submit to it. We call upon every enlightened disciple of Lord Bacon to approve the steps of this process, and to acknowledge, that the same habits of philosophising to which science is indebted for all her elevation in those latter days, will lead us to cast down all our lofty imaginations, and bring every thought into the captivity of the obedience of Christ.

198. But something more remains to be done. The mind may have discernment enough to acquiesce in the speculative justness of a principle; but it may not have vigour or consistency enough to put it into execution. Lord Bacon pointed out the method of true philosophising; yet, in practice, he abandoned it, and his own physical investigations may be ranked among the most effectual specimens of that rash and unfounded theorising, which his own principles have banished from the schools of philosophy. Sir Isaac Newton completed in his own person the character of the true philosopher. He not only saw the general principle, but he obeyed it. He both betook himself to the drudgery of observation, and

he endured the pain which every mind must suffer in the act of renouncing its old habits of conception. We call upon our readers to have manhood and philosophy enough to make a similar sacrifice. It is not enough, that the Bible be acknowledged as the only authentic source of information respecting the details of that moral economy, which the Supreme Being has instituted for the government of the intelligent beings who occupy this globe. Its authenticity must be something more than acknowledged. It must be felt, and, in act and obedience, submitted to. Let us put them to the test. "Verily I say unto you," says our Saviour, "unless a man shall be born again, he shall not enter into the kingdom of God." "By grace ye are saved through faith, and that not of yourselves, it is the gift of God." "Justified freely by his grace through the redemption that is in Christ Jesus, whom God has set forth to be a propitiation through faith in his blood." We need not multiply quotations; but if there be any repugnance to the obvious truths which we have announced to the reader in the language of the Bible, his mind is not yet tutored to the philosophy of the subject. It may be in the way, but the final result is not yet arrived at. It is still a slave to the elegance or the plausibility of its old speculations; and though it admits the principle, that every previous opinion must give way to the supreme authority of an actual communication from God, it wants consistency and hardihood to carry the principle into accomplishment. (T. C.)

CHRISTIANSTADT, a town of Sweden, and the capital of the province of Schonen or Scania, was built in 1614 by Christian IV. king of Denmark, but ceded to Sweden by the treaty of Roschild in 1658. "The town," says Mr Coxe, "is small, but neatly built, and is esteemed the strongest fortress in Sweden. The houses are all of brick, and mostly stuccoed white. It stands in a marshy plain, close to the river Helge-a, which flows into the Baltic at Ahus, at the distance of twenty miles, and is navigable only for small craft of seven tons burthen. English vessels annually resort to this port for alum, pitch, and tar. The inhabitants have manufactures of cloth and silken stuffs, and carry on a small degree of commerce." Kuttner represents Christianstadt as a wretched disagreeable place, containing none of the good houses which are seen in the Swedish towns, and exhibiting none of that opulence which manufactures generally diffuse. The chief public buildings are the arsenal, the governor's house, the principal church, and the bridge. Population 1980. According to a trigonometrical survey, it is situated in 14° 10′ East Long. and 56° 1′ 15″ North Lat. See Coxe's *Travels in Poland, Russia, and Sweden*, vol. iv. p. 289; Kuttner's *Travels through Denmark, Sweden*, Lett. X.; Reichard's *Guide des Voyageurs, &c.* vol. i. p. 99, 4th edit. (*w*)

CHRISTINA, in biography, a celebrated queen of Sweden, the daughter and only child of the great Gustavus Adolphus. When her father fell in the battle of Lutzen, in 1632, she was only five years of age. The affairs of her kingdom, however, went on prosperously under the superintendance of the Chancellor Oxenstiern, and by the conduct and bravery of the able generals who at that time commanded in the Swedish armies. By this means, the preponderancy which Sweden had acquired in the Protestant league, under the reign of Gustavus, was preserved undiminished during the minority of Christina.

At a very early age, this princess discovered an invincible antipathy for the employments and conversation of her own sex, of which she takes notice in her memoirs; and she had the natural awkwardness of a man, with respect to the little occupations which are appropriate to females. On the other hand, she was passionately fond of violent exercise, and the amusements which consist in feats of strength and agility. Her studies, too, were of the masculine order; and she made no mean proficiency in the abstract sciences, and in the learned languages. At an early age, she was versant in legislation and government, and able to read the Greek historians in the original. As she advanced in years, the love of letters seems to have become her ruling passion; and had a powerful influence on the fortune of her future life.

The general peace of Westphalia, in 1648, restored tranquillity to Europe; and was concluded on terms which were sufficiently honourable to Sweden, at that time in the zenith of its military reputation. A few years previous to this event, Christina had assumed the reins of government at the early age of eighteen, and proved herself fully able to conduct the affairs of a powerful kingdom. It is not, therefore, to be wondered at, that about this period almost all the princes of Europe aspired to the honour of her hand. Among others were the kings of Spain and Poland, the king of the Romans, the prince of Denmark, the Elector Palatine, the elector of Brandenburg, Don John of Austria, and Charles Gustavus, Count Palatine, her own first cousin, and heir-apparent to the crown. She was deaf, however, to all their proposals, as well as to the anxious solicitations of her people; pleading as the motives of her refusal, diversity of political interests, of manners, or of religion. When pressed more closely by her subjects, she made no scruple to avow an insuperable aversion to matrimony; declaring, "that there were certain duties required by the nuptial ceremony, with which she could not persuade herself to comply." Her high spirit, probably, could not brook that subjection which is entailed by the matrimonial tie upon the female sex. To prove how much she was in earnest in her resolution, she solemnly appointed Gustavus her successor; but without admitting him to any participation in the rights of the crown during her own life. Her vow of celibacy in no degree diminished the attachment which, at this period, she received from her subjects; and which was powerfully evinced, by the general expression of joy at a narrow escape which she made from assassination by the hand of a madman, as she was assisting at a public act of devotion in the chapel of the castle of Stockholm, which was in a great measure due to her own intrepidity and presence of mind. Not long after, the life of the queen was exposed to a no less imminent danger by an accident, from which she also had the good fortune to escape unhurt. Having given orders for some ships of war to be equipped at the port of Stockholm, she went to inspect them when they were finished; but as she was going on board, across a narrow plank, the foot of her conductor, Admiral Fleming, slipped, and in his fall he drew the queen along with him, into a part of the sea which was nearly 90 feet deep. The queen's first equerry, Anthony Steinberg, instantly threw himself into the water, laid hold of her robe, and, with such assistance as was at hand, fortunately dragged her on shore. During this accident, her recollection was such, that the moment her head was above water, she cried out, "Take care of the admiral." When she got on dry land, she betrayed no emotion either by her gesture or countenance; and the same day she dined in public, and entertained her company with a humorous account of her adventure.

In the year 1650, Christina was crowned with great pomp and splendour; and as, at this period, her kingdom enjoyed a state of uninterrupted tranquillity, she felt herself at liberty to gratify her ruling passion for letters; and declared herself the patroness of the learned, and the encourager of the fine arts throughout Europe. She invited to her court, and was anxious to have about her person, all the distinguished characters of her time. Among these we may reckon Grotius, Pascal, Bochart, Descartes, Gassendi, Saumaise, Vossius, Heinsius, Meibornius, Menage, Bayle, Madame Dacier, Filicaia, and many others. Her preference, however, seems to have been directed more by general fame, than by her own judgment, or discrimination of their several excellencies; for Menage stood much higher in her esteem than Descartes, whom she disgusted, and at length wholly neglected. Her want of a just sense of merit was remarkably evinced, by the favour which she shewed to an adventurer called Michon, but better known by the name of *Bourdelot*, who was brought to court by the learned Saumaise; but had little to recommend him, except his sprightliness and buffoonery. This unworthy minion, not only took place of true literary merit at the Swedish court, but was able to supplant, in the favour of the queen, Count Magnus de la Gardie, son of the constable of Sweden, who was a relation, a favourite, and a reputed lover of Christina. She was compelled, however, by the public indignation, to banish Bourdelot; and he was no sooner gone, than her regard for him seemed to cease. So lavish was Christina in her gifts to her literary favourites, and so profuse in her collection of books, manuscripts, medals, paintings, and antiques, that she brought the finances of her kingdom into considerable disorder.

At first Christina appeared attached to the duties of a sovereign; but two years had scarcely elapsed from the period of her coronation, when, with a characteristic fickleness, she became disgusted with the fatigues and embarrassments of royalty; and determined to abdicate the crown, and, in private life, to enjoy independence and literary ease. In 1652, she communicated her resolution to the senate; but was prevailed upon, by their remonstrances, in which her successor Gustavus joined, to relinquish her intention. Finding, however, her repugnance at reigning rather increase than diminish, she finally effected her purpose in 1654, when she was only in her twenty-eighth year; although it appears by one of her letters to M. Canut, that she had meditated this project eight years before, and communicated it to him five years before it took place. The fickleness of Christina was still further evinced, by her abjuring her religion, at the same time that she abdicated her crown. Her declaring herself a papist necessarily gave great disgust to her Protestant subjects; but was a mighty triumph for the Romanists.

Immediately after her abdication, Christina quitted Sweden, exhibiting the greatest joy on being now the uncontrouled mistress of her actions. When she came to a little brook, which separates Sweden from Denmark, she got out of her carriage, and, leaping on the other side, exclaimed in a transport of delight, "At last I am free, and out of Sweden, whither, I hope, I shall never return." She now dismissed her female attendants, and even laid aside the habit of her sex. "I would become a man (said she); yet I do not love men, because they are men, but because they are not women." The same inconsistency of temper, however, still continued to actuate Christina, and induced her to shift continually from place to place. She first took up her abode at Brussels; from thence she went to Rome; from Rome to France; and from France she went to Rome again. She also visited Hamburgh; and went twice to Sweden, where she was by no means well received.

While in France, she was treated with much respect by the court; and had apartments assigned her by Louis XIV. at Fontainbleau. But she soon disgusted the Parisians, by her violation of the manners of the country, which she affected to treat with great ridicule, and by the rudeness and indelicacy of her conversation. It was here, also, that she committed an action, which has affixed an indelible stain upon her memory, the murder of her master of the horse, Monaldeschi, who, having on some account incurred her displeasure, was stabbed by her order, by two of her domestics, in an apartment adjoining that in which she herself was. After this, Christina became sensible that she was regarded with horror in France, and would gladly have visited England; but received no encouragement for that purpose from Cromwell, who was then in power.

It was on the death of Charles Gustavus in 1660, that she took her first journey to Sweden, being, with characteristic fickleness, inspired by the desire of recovering her crown. Her ancient subjects, however, were altogether indisposed towards her and her new religion, and insisted on a second renunciation of the throne, before they agreed to confirm her revenues. In 1662, some differences with the Pope, and the ill payment of her appointments, induced her again to visit her native country; but the conditions annexed by the senate to her residence there rendered her stay very short. She then went to Rome, where she resided with little interruption till her death in 1689. During this interval, she cultivated a correspondence with the learned men all over Europe; but her restless disposition led her, at the same time, to intrigue in all the political cabals of the times. Though she had resigned the crown of Sweden, she canvassed for that of Poland. At the peace of Nimeguen, she sent a plenipotentiary to take care of her interests, who with difficulty procured the remittance of her arrears. During the civil contest in France, called the *Fronde*, she officiously offered her mediation to both parties, conceiving herself capable of reconciling their interests, and calming their passions. On the revocation of the edict of Nantz in 1685, she wrote to the French ambassadors in Sweden, animadverting, with much freedom and good sense, on the folly of making converts by persecution, and the bad policy of banishing useful artizans for a difference in religious faith. Her letter was published by Bayle, at which Christina was greatly offended; but afterwards appeased, on the submission of the philosopher.

Upon the whole, with some striking virtues, this princess had many faults. She had magnanimity, talents, and learning; but she was fickle, violent, intriguing, and revengeful. She says of herself, that she was "mistrustful, ambitious, passionate, haughty, impatient, contemp-

Christopher's.

tuous, satirical, incredulous, undevout, of an ardent and violent temper, and extremely amorous;" a propensity to which, she would have us to understand, her virtue and her pride were always superior. In a letter written to Mademoiselle de Scudery some time before her death, she expresses herself with great tranquillity on the prospect of her approaching end; and she passed the last scene with philosophical composure. She died at the age of sixty-three, leaving behind her many letters; a "Collection of Miscellaneous Thoughts or Maxims;" and "Reflections on the Life and Actions of Alexander the Great." See Coxe's *Travels; Univ. Hist.*; and *Gen. Biog.* See also SWEDEN. (*m*)

CHRISTOPHER'S, ST. or ST KITT'S, is one of the Leeward West India islands, and was called *Liemuiga*, or the Fertile Island, by the Charaibes, by whom it was possessed when discovered by Columbus in 1493, who gave it his own Christian name.

St Christopher's is divided into nine parishes, and contains four towns and villages, viz. the capital Basseterre, which contains above 800 houses, Sandy Point, Old Road, and Deep Bay. The principal fortifications are Fort Charles and Brimstonhill, three batteries at Basseterre, one at Figtreebay, and a fourth at Palmeto Point.

The island is about forty two miles in circumference, and its superficial extent is about 43,726 acres. The interior part of the island consists of naked precipices, and barren mountains, the highest of which is Mount Misery, which is about 3711 feet high, and appears to have been formerly a volcano. The plains, which are extremely fertile, are appropriated to the growth of sugar, and to pasturage, about 17,000 acres being devoted to the former, and 4000 to the latter. Provisions and a little cotton are the only other articles of produce. The average quantity of sugar produced annually is about 16,000 hogsheads of 16 cwt.; and as only one half of the cane land is annually cut, the produce of each acre is about two hogsheads of 16 cwt.—a return which is supposed to exceed that of any other sugar country in the world. The soil of the island is a light and porous dark grey loam, lying above a stratum of gravel, about ten inches deep. From 3000 to 4000 barrels of rum are annually made in the island.

Among the mountains in the centre of St Christopher's, there is one which contains mines of sulphur, and there is another not far distant from Fort Charles, in which there is said to be a mine of silver. In the south-east part of the island there are very fine salt ponds, which produce most excellent salt: One of these is more than a hundred acres in extent, and is surrounded with several lesser ponds, and with a number of small hills.

The following Table contains an accurate statement of the articles exported into St Christopher's in the years 1804, 1805, 1806.

Table of the Articles imported into St Christopher's in the Years 1804, 1805, and 1806.

Articles imported.	Great Britain.	British Colonies.	United States.	Other Countries.
Imports in 1804.				
Corn	Bushels. 17,244		Bushels. 12,619	Bushels. 1.300
Bread, flour, & meal	Cwts. 16,000		Cwts. 27.483	Cwts. 2,266
Rice			Barrels. 243	Barrels. 5
Beef and Pork	Barrels. 396		Barrels. 3700	Barrels. 210
Dry fish	Bar. Quin. 0 10		Bar. Quint. 6 3550	Bar. Quin. 0 50
Pickled fish	Barrels. 1787	Barrels. 414	Barrels. 2399	Barrels. 96
Butter	Firkins. 2499		Firkins. 238	Firkins. 30
Cows and oxen	2		136	23
Sheep and hogs			16	
Oak and pine, Boards & timber			Feet. 1,323,542	Feet. 82,960
Shingles			No. 1,702,550	No. 18,000
Staves			No. 452,862	No. 12,002
Imports in 1805.				
Corn	Bushels. 16,498		Bushels. 13,549	Bushels. 1180
Bread, flour & meal	Cwts. 1810		Cwts. 27,092	Cwts. 4802
Rice			Barrels. 263	Barrels. 1
Beef and pork	Barrels. 437		Barrels. 694	Barrels. 10
Dry fish	Bar. Quin. 0 2	Bar. Quin. 0 15	Bar. Quin. 0 2993	Bar. Quin. 0 141
Pickled fish	Barrels. 1877	Barrels. 310	Barrels. 1291	Barrels. 210
Butter	Firkins. 1034		Firkins. 443	
Cows and oxen	1		187	34
Sheep and hogs			20	
Oak and pine, Boards & timber			Feet. 867,911	Feet. 143,000
Shingles			No. 1,432,800	No. 17,500
Staves			No. 430,799	No. 466,500
Imports in 1806.				
Corn	Bushels. 31,759		Bushels. 19,299	Bushels. 764
Bread, flour, & meal	Cwts. 3920		Cwts. 21,017	Cwts. 3692
Rice	Barrels. 1		Barrels. 238	Barrels. 45
Beef and pork	Barrels. 222		Barrels. 1575	Barrels. 37
Dry fish	Bar. Quin. 1 4	Bar. Quin. 0 607	Bar. Quin. 34 637	Bar. Quin. 0 199
Pickled fish	Barrels. 1885	Barrels. 618	Barrels. 1603	Barrels. 939
Butter	Firkins. 901		Firkins. 364	Firkins. 119
Cows and oxen			166	
Sheep and hogs			31	
Oak and pine, Boards & timber			Feet. 1,523,383	Feet. 12,000
Shingles		No. 12,000	No. 1,510,175	No. 3000
Staves			No. 661,460	No. 70,500

The population of St Christopher's, in 1637, amounted to about 13,000. It contains at present about 20,000 blacks, and 8000 whites. West Long. 63° 17′, North Lat. 17° 15′. See Edward's *Hist. of the West Indies*, and Gray's *Letter from Canada*. See also the article West Indies. (*w*)

CHROMA, in Music, or Chromati, is the name by which M. Henfling has denominated the interval whose ratio is $\frac{24}{25}$, $=36\,\Sigma+f+3m$, being the Semitone *Minor*, which see. (ϱ)

CHROMATIC, in Music, is applied to such scales or passages, as proceed wholly, or in a larger degree than usual, by half notes, semi or hemitones; in which it is usually opposed to diatonic, or such scales or passages as proceed principally by whole notes or tones. The ancient Greeks had, or pretended to have, so many varieties of scales, or modes of dividing the tetrachord or minor fourth, into three degrees or intervals, that they have been classed into *genera*, of which the chromatic is one; which is distinguished by the two lower intervals being hemitones, and the other a third of some sort. Music of this genus is said to have had a tendency to produce or heighten expressions of grief or affliction, and its name to be derived from χρωμα, which is supposed to express a colour, and the blending or shading of such into each other; and so the chromatic semitones were supposed to blend or connect the tones, by the framers of these systems, as we are told. See Chromaticum, *Intensum, Molle, Sesquialterum*, and *Toniæum*. (ϱ)

CHROMATIC Diesis, in Music, (∂), is an interval so named and marked by Dr Callcott, which remains when the euharmonic diesis is taken from a medius semitone; or, when a major semitone is taken from the sum of a medius and minor semitone; and though noticed by no writer that we have read but Dr Callcott before Mr Liston, is rather an important interval, as the difference between ♭F and ✻E, and between ♭C and ✻B, in his euharmonic scale, or that adapted to perfect harmony. The ratio of the *chromatic diesis* is $\frac{16384}{16875}$; the component primes $\frac{2^{14}}{3^3\,5^4}$; its common logarithm is .9871761,5779; in the binary logarithms of Euler, or decimals of an octave, it is =.0426006; in those in which the major comma is the modulus, it is 2.376960; and where the schisma is the modulus or unit =26.165386; its value in the new notation is $26\,\Sigma+f+2m$; in the notation of elements of perfect tune, it is ƒ + Σ; in diatonic elements T + 2*t* — 3S; in chromatic elements 𝔖 + 𝒮 — S, as before observed; and in concordant, or tunable elements, it is 4 IIIds—3-4ths, whence, on such an instrument as Mr Liston's organ, it can be correctly tuned by perfect intervals only.

The following equations exhibit the value of the *chromatic diesis*, in terms of all the several intervals in the Table, Plate XXX. Vol. II. viz.

∂ = ƒ + Σ
= π + c
= ƒ€ + 2c
= đ + D
= 2đ + r
= ƒc + E

= 2𝔖 — S
= 2𝒮 — L
= 2π — ƒ€
= 2D — r
= 4III — 3-4ths

∂ = 𝔖 — E
= S — €
= ƒ — R
= P — ƒ
= L — 2€
= S — 2E

∂ = 26Σ + f + 2m
= 24Σ + 7f + 2d
= 16Σ + m + φ
= 12Σ + m + D
= 4Σ + f + 2c
= 11Σ + m + π
= 2Σ + χ + E

= 2Σ + 2c + r
= Σ + π + €
= Σ + χ + 2c

= 2f + 7đ — P
= f + 𝒮 — φ
= R + E — f

∂ = P + 𝒮 — S
= P + ƒ — S
= P + π — 𝔖
= P + ƒ€ — 𝒮
= P + 2𝒮 — T
= P + D — L
= S + 𝒮 — S
= S + Σ — ƒ
= T + t — 3S
= Σ + t — S
= 26d + 79f — 24m
= 27Σ + 3m — F
= 32Σ + 3m — R
= 2𝒮 + đ — P

∂ = T — E — S
= T — P — 2€
= €̄ — S — €
= S — c — 2€
= S — E — €
= 2S — P — 3€
= 2𝔖 — P — €
= 2π — 4Σ — f
= 2D — 2Σ — f
= S — 42Σ — 4m
= P — 32Σ — 3m
= 𝔖 — 21Σ — 2m
= L — 20Σ — 2m
= 𝒮 — 10Σ — m

(ϱ)

CHROMATIC Diesis, (least) of Chambers, Holder, &c. is an interval whose ratio is $\frac{24}{25}$, $=36\,\Sigma+f+3\,m$, and is the Semitone *Minor* 𝒮, which see. (ϱ)

CHROMATIC Dissonant Triad, in Music, or the *Superfluous Triad*, is a chord wherein two major or two minor thirds occur, as $\frac{\text{III}}{\text{III}}$ or $\frac{3}{3}$; the consonant triad consisting always of a major and minor third, as $\frac{\text{III}}{3}$, or $\frac{3}{\text{III}}$. (ϱ)

CHROMATIC Elements, in Music, or *Semitones o the Chromatic Douzeave Scale*, are the major, the medius, and minor semitones, S, 𝔖, and 𝒮, (see Plate XXX. Vol. II.) which were so denominated by Mr Farey in the *Philosophical Magazine*, vol. xxxix. p. 414, on finding, that upon Mr Liston's euharmonic, or perfect harmony organ, whatever changes are made by the use of the pedals for ♭s and ✻s among his 24 principal notes, these three intervals, and no others, (except the semitone maximum S between B✻ and C✻, with the 3d ✻ pedal,) are found between the adjacent notes of every new scale, in the progress of modulation. Thus in Mr Liston's *original scale*,

C C✻ D E♭ E F F✻ G G✻ A B♭ B C
𝔖 S S 𝒮 S 𝔖 S 𝒮 S S 𝔖 S
I II 3 III 4 V 6 VI 7 VII VIII

which are related to the key C, as in the lower line, by intervals major and minor, the differences or intermediary intervals are as expressed in the intermediate line and spaces; in which it may be observed, that if we begin at the 𝔖, between F and F✻, or above the 4th of the key, and proceed either upwards or downwards, the successive intervals and their order, are the same to S between B and C, or above the VIIth of the key; and in like manner, if we begin at the S last mentioned, or half tone below the key, and proceed both upwards and downwards, the order and magnitude of the intervals is the same. In the use of every new pedal, the order of these elements is changed, still however we have always 7 S + 3 𝔖 + 2 𝒮 = VIII, except with the use of Mr Liston's second and third sharp pedals, when 𝒮 below B✻ is substituted for S, and S + C above it for the 𝔖, that was before placed below C✻. (ϱ)

CHROMATIC French Horn. Since about the beginning of the 18th century, the attention of different musicians has been turned to the completing of the chromatic scale, or supplying the horn (and trumpet also) with additional notes, both for performing all the notes true in its own fundamental key, and for modulating into other keys. The late Mr Charles Clagget invented, and took out a patent a short time previous to 1790, and for a time made double horns and trumpets, one of which was tuned half a note lower than the other, and by means of a connected mouth-piece to these tubes, in which there was a valve moveable by the finger, the performer could sound either of these tubes at pleasure, and thus it was pretended, that a scale was produced, by sometimes using one tube and sometimes the other for different notes, and that the instrument was thus perfected for all the keys in which music is usually written. The following expressions for the notes of the horn or trumpet in ratios, to the whole length of the tube as unity, and, in our usual notation, will shew the fallacy of these pretensions, and prove useful on other occasions to the musical calculator, viz.

Notes.	Ratios.	Values. Σ	f	m	Intervals and Temperaments. I
C	$\frac{1}{2}$	612.	12	53	VIII
B	$\frac{8}{15}$	555.	11	48	VII
	$\frac{4}{7}$	494.05294	10	43	7th—13.94706 $\Sigma - m$
A	$\frac{8}{13}$	428.58107	9	37	VI—22.41893 $\Sigma - 2m$
	$\frac{16}{27}$	394.	8	34	6th—21. $\Sigma - 2m$
G	$\frac{2}{3}$	358.	7	31	V
	$\frac{16}{23}$	320.46026	6	28	5th + 9.46026 $\Sigma + m$
F	$\frac{8}{11}$	281.25171	5	24	4th + 27.25171 $\Sigma + 2m$
E	$\frac{4}{5}$	197.	4	17	III
	$\frac{16}{19}$	151.72902	3	13	3rd— 9.27098 $\Sigma - m$
D	$\frac{8}{9}$	104.	2	9	II
	$\frac{16}{17}$	53.53181	1	5	2d — 3.46819 Σ
C	$\frac{1}{1}$				I

In the column of ratios, the denominators shew the order in which these 12 notes arise by harder and harder blowing in the same tube; and the numerators, as multiples of 2, shew the successive octaves upwards, in which these notes are produced. In the last column, the temperaments or errors of the false notes of horns and trumpets are shown; thus the 4th of the key of C is 27¼ schismas and more *too sharp*, and the major sixth of the same key nearly 22½ schismas *too flat*, &c.; whence it is abundantly evident, that no *two* tubes can mutually supply or correct the false notes of the other, as Mr Clagget's invention assumes; nor will the same succeed any better, in fitting it for transposition or modulation into other keys, as will be easy for any one to try, by adding $612\Sigma + 12f + 53m$ to each of these notes in col. 3 for another octave above this, and then from these, when necessary, deducting the value of the note that is assumed as the new key, and comparing the difference with the perfect intervals in Plate XXX. Vol. II. whence the temperaments, or errors from the respective consonances, will appear for the octave above the new key, as they do in this table for that above C.

French-horns, bugle-horns, and trumpets, have of late been made by Mr Perceval, of St James's Street, with six side finger-holes, as in a flute, for supplying the notes that are false on the common instruments. It is evident, however, that though a considerable approach may be made on such polyphonian or chromatic horns, &c. by the adjustment of the places of the holes on the tube, to a perfect scale in C, or any other key, or even to any assumed tempered scale; yet it is well known, that modulation cannot be truly effected by help of any 12 notes whatever, except in that most inharmonious of all systems, the *equal temperament*, which no good ear could endure to hear in the few trials that have been made of it, much as it is talked and written about. The slide for lengthening or shortening the tube of the trumpet, which Mr Hyde has long used with such good effect in our best concerts, and the regulation of the notes on the horn which the Petrides effect, by thrusting their hand or a turned block of wood into the mouths of their horns, have not the effect of chromatic trumpets or horns, of which we have been speaking, where the scale consists of half-tones only; but by this management they become perfect instruments, (combined with the crooks that the latter use in different keys,) on which they can effect any of the small changes, for producing perfect harmony with the other notes of the piece, as on violins, voices, and Mr Liston's organ. (ϱ)

CHROMATIC INTERVAL, the greater, of Wood and Gregory, has a ratio of $\frac{15}{16}, = 57\Sigma + f + 5m$, and is the *Major* SEMITONE S; which see. (ϱ)

CHROMATIC *Interval*, the lesser, of Wood and Gregory, has a ratio of $\frac{24}{25}, = 36\Sigma + f + 3m$, and is the *Minor* SEMITONE S; which see. (ϱ)

CHROMATIC SEMITONE, greater, of Dr Callcott, has a ratio of $\frac{128}{135}, = 47\Sigma + f + 4m$, and is the SEMITONE *Medius*, S; which see. (ϱ)

CHROMATIC *Semitone*, lesser, of Dr Callcott, S. Rootsey, M. Tartinig, &c. has a ratio of $\frac{24}{25}, = 36\Sigma + f + 3m$, and is the SEMITONE *Minor S*. Dr Callcott in Art. 228, 1st Edit. of his "Grammar," has shown that these two chromatic semitones exist in the scale, according as they result from T or t, viz. T = S and t = S; but unfortunately, in Art. 163 to 175, 212 to 224, 315, &c. this essential distinction is not observed; but the term chromatic semitone is used synonymously with FLAT and SHARP. See those Articles in our work, and the *Philosophical Magazine*, Vol. xxxix, p. 375. (ϱ)

CHROMATICUM INTERSUM, in the Greek Music, was distinguished among their *genera*, according to Ptolemy, by a tetrachord, ascending according to the following numerical ratios, viz. $\frac{21}{22} \times \frac{11}{12} \times \frac{6}{7} = \frac{3}{4}$, which intervals, in the notation which we have adopted, (see Plate XXX. in Vol. II.) are as follows, viz.

$$\begin{aligned} \tfrac{6}{7} &= 136.052904\Sigma + 3f + 12m \\ \tfrac{11}{12} &= 76.748294\Sigma + 2f + 7m \\ \tfrac{21}{22} &= \underline{41.198802\Sigma \qquad + 3m} \\ \text{4th} &= 254.000000\Sigma + 5f + 22m \end{aligned}$$

(ϱ)

CHROMATICUM MOLLE, or soft chromatic, had, according to Euclid, a tetrachord ascending by a triental diesis, another such diesis, and a spiss or incomposite interval making up the fourth. This in our notation is as follows, viz.

$$\begin{aligned} & 184.766442\Sigma + 3f + 16m \\ \tfrac{1}{3}T &= 34.616779\Sigma + f + 3m \\ \tfrac{1}{3}T &= \underline{34.616779\Sigma + f + 3m} \\ \text{4th} &= 254.000000\Sigma + 5f + 22m \end{aligned}$$

The first of the above intervals was, it is said by Holder, accounted to be, "a tone and half and third part of a tone, that is, 1⅚ of a major tone, but which is $= 190.620711\Sigma + 4f + 16m$; differing 6.003931Σ from the above, or half the diaschisma, or ½d, what Galileo and Glarcanus call a *schisma*.

According to Aristoxenus, in this genus the tetrachord was divided into 30 equal parts, of which the tetrachord was thus composed, viz. 4+4+22=30, whence

$$\begin{aligned}\tfrac{22}{30}\text{ths or }\tfrac{11}{15}\times 4\text{th} &= 186.36750\Sigma+3f+16m\\ \tfrac{4}{30}\text{ths or }\tfrac{2}{15}\times 4\text{th} &= 33.81625\Sigma+f+3m\\ \tfrac{4}{30}\text{ths or }\tfrac{2}{15}\times 4\text{th} &= \underline{33.81625\Sigma+f+3m}\\ 4\text{th} &= 254.00000\Sigma+5f+22m\end{aligned}$$

According to Ptolemy, the numerical ratios in this genus were $\frac{27}{28}\times\frac{14}{15}\times\frac{5}{6}=\frac{3}{4}$, or the tetrachord, whence,

$$\begin{aligned}3d\text{ or }\tfrac{5}{6} &= 161.000000\Sigma+3f+14m\\ \tfrac{14}{15} &= 60.947096\Sigma+f+5m\\ \tfrac{27}{28} &= \underline{32.052904\Sigma+f+3m}\\ & 254.000000\Sigma+5f+22m\end{aligned}$$

Dr Pepusch is of opinion, in which he is followed by Mr Overend, that this genus was as follows, viz.

$$\begin{aligned}3d+E &= 182\Sigma+3f+16m\\ \mathcal{S} &= 36\Sigma+f+3m\\ \mathcal{S} &= \underline{36\Sigma+f+3m}\\ & 254\Sigma+5f+22m\end{aligned}$$

By having all these reduced to one rotation, as above, the curious reader of the authors above mentioned, can the readier compare these very different and discordant scales. (ϱ)

CHROMATICUM Sesquialterum, *Homiolium*, or *Sescuplum*, was a genus of the Greek music, which, according to Euclid, ascended by one and a half of his euharmonic diesis, or quarter of the major tone, another such an interval, and an incomposit, as follows, viz.

$$\begin{aligned} & 176.068934\Sigma+3f+16m\\ \tfrac{3}{8}T &= 38.965533\Sigma+f+3m\\ \tfrac{3}{8}T &= \underline{38.965533\Sigma+f+3m}\\ 4\text{th} &= 254.000000\Sigma+5f+22m\end{aligned}$$

The first of these intervals was, it is said by Holden, accounted to be 1½ of a major tone, or seven quarter tones, $=182.072865\Sigma+3f+16m$, differing 6.003931Σ, or just half of the diaschisma, or ½d, as before, in the molle.

According to Aristoxenus, the tetrachord, in this genus, was divided into 30 parts, and these distributed as follows, viz. $4\frac{1}{2}+4\frac{1}{2}+21=30$, whence

$$\begin{aligned}\tfrac{21}{30}\text{ths or }\tfrac{14}{20}\times 4\text{th} &= 177.870114\Sigma+3f+16m\\ \tfrac{4\frac{1}{2}}{30}\text{ths or }\tfrac{3}{20}\times 4\text{th} &= 38.064943\Sigma+f+3m\\ \tfrac{4\frac{1}{2}}{30}\text{ths or }\tfrac{3}{20}\times 4\text{th} &= \underline{38.064943\Sigma+f+3m}\\ 4\text{th} &= 254.000000\Sigma+5f+22m\end{aligned}$$

Dr Pepusch and Mr Overend state this genus as follows, viz.

$$\begin{aligned}3d &= 161\Sigma+3f+14m\\ \mathcal{S} &= 36\Sigma+f+3m\\ \mathfrak{S} &= \underline{57\Sigma+f+5m}\\ 4\text{th} &= 254\Sigma+5f+22m\end{aligned}$$

This is also the chromatic in Didymus's genera. (ϱ)

CHROMATICUM Toniæum, or *Tonicum*, was a genus, according to Euclid, where the tetrachord rose by hemitone, hemitone, and trihemitone as follows, viz.

$$\begin{aligned} & 149.992138\Sigma+3f+14m\\ \tfrac{1}{2}T &= 52.003931\Sigma+f+4m\\ \tfrac{1}{2}T &= \underline{52.003931\Sigma+f+4m}\\ 4\text{th} &= 254.000000\Sigma+5f+22m\end{aligned}$$

The first of the above intervals, is the comma-deficient minor third, $=150\Sigma+3f+13m$, (though differently expressed, in order to throw the decimal parts, all on the schisma,) and is the trihemitone of Euclid.

According to Aristoxenus, this tetrachord is thus divided, viz. 6+6+18=30, whence

$$\begin{aligned}\tfrac{18}{30}\text{ths or }\tfrac{3}{5}\times 4\text{th} &= 152.39370\Sigma+3f+14m\\ \tfrac{6}{30}\text{ths or }\tfrac{1}{5}\times 4\text{th} &= 50.80315\Sigma+f+4m\\ \tfrac{6}{30}\text{ths or }\tfrac{1}{5}\times 4\text{th} &= \underline{50.80315\Sigma+f+4m}\\ 4\text{th} &= 254.00000\Sigma+5f+22m\end{aligned}$$

Dr Pepusch and Mr Overend state this genus as follows, viz.

$$\begin{aligned}T+\mathcal{S} &= 140\Sigma+3f+12m\\ \mathfrak{S} &= 57\Sigma+f+5m\\ \mathfrak{S} &= \underline{57\Sigma+f+5m}\\ 4\text{th} &= 254\Sigma+5f\times 22m\end{aligned}$$

The genera that are ascribed to Archytas, have a chromatic different from any of the above, viz.

$$\begin{aligned}\tfrac{27}{32} &= 150.000000\Sigma+3f+13m\\ \tfrac{224}{243} &= 71.947096\Sigma+f+6m\\ \tfrac{27}{28} &= \underline{32.052904\Sigma+f+3m}\\ 4\text{th} &= 254.000000\Sigma+5t+22m\end{aligned}$$

Aristides ascribes another chromatic to the ancient Pythagoreans, having the same comma-deficient minor third as above, viz.

$$\begin{aligned}\tfrac{27}{32} &= 150.00000\Sigma+3f+13m\\ \tfrac{17}{18} &= 50.46819\Sigma+f+4m\\ \tfrac{16}{17} &= \underline{53.53181\Sigma+f+5m}\\ 4\text{th} &= 254.00000\Sigma+5f+22m\end{aligned}$$

A genus ascribed to Eutosthenes, also differs from any of the above, as follows, viz.

$$\begin{aligned}\tfrac{5}{6} &= 161.000000\Sigma+3f+14m\\ \tfrac{18}{19} &= 47.729018\Sigma+f+4m\\ \tfrac{19}{20} &= \underline{45.270982\Sigma+f+4m}\\ & 254.000000\Sigma+5f+22m\end{aligned}$$

(ϱ)

CHRONOLOGY.

Definition.

CHRONOLOGY, from *χρονος time*, and *λογος doctrine*, is that science which treats of the natural and artificial divisions of time, and refers to the points which it thus marks out, the various events recorded in history, &c.

Division.

In order to convey to our readers as full and distinct an account of this useful subject as our limits will permit, we shall divide it into the following Chapters: I. MATHEMATICAL CHRONOLOGY; II. HISTORICAL CHRONOLOGY; III. COMPARATIVE CHRONOLOGY; and, IV. TABULAR CHRONOLOGY.

CHAP. I.

Mathematical Chronology.

Mathematical chronology.

MATHEMATICAL chronology treats of the division of time by days, months, years, and cycles, and of the application of these divisions to the purposes of civil life.

SECT. I. *On the Day.*

On the day.

A day is that portion of time which elapses while the earth performs a complete revolution about its axis; and its length is measured by observing the precise instant when the centre of a star passes the meridian on two consecutive days. A day thus measured is called the *sidereal day*, and consists of 23 hours, $56'\,3''.4$. A *solar* or *natural* day, is that portion of time which elapses between the arrival of the sun at the meridian on two consecutive days. The mean length of the solar day is 24 hours; but, owing to the inclination of the earth's axis to the ecliptic, and the unequal motion of the earth in its orbit, the solar days are of unequal length, sometimes exceeding, and sometimes falling short of 24 hours. The hour hand of a well-regulated clock performs two complete revolutions on the dial plate in the course of a mean solar day, and twice 365 or 720 revolutions in the course of a year; whereas the shadow of the stile or gnomon of a sun dial, sometimes performs more and sometimes less than one revolution during a mean solar day, but always completes 365 revolutions in the course of one year. The difference between the mean solar time, as shewn by a well-regulated clock, and the apparent time, as shewn by a sun dial, is called the equation of time, or the equation of natural days, and has been fully explained in the article ASTRONOMY, Vol. II. Pp. 652, 797.

Although the inhabitants of every country have agreed in adopting the mean solar day as the unit of their scale for measuring time, yet they have differed from each other in fixing its commencement. The following Table will shew distinctly the practice of various ancient and modern nations.

Table of the commencement of the day among various nations.

Table shewing the Times at which different Nations have begun or begin the Civil Day.

Ancient Babylonians	at sunrise.
Ancient Persians	ditto.
Ancient Syrians	ditto.
Ancient Jews	ditto.
Almost all Eastern nations	ditto.
Inhabitants of Majorca, Minorca, and Ivica	ditto.
The Greeks and the inhabitants of the islands of the Archipelago	ditto.
Athenians and the inhabitants of Attica	at sunset.
The Marcomanni	ditto.
Austrians	ditto.
Turks	ditto.
Bohemians	ditto.
Silesians	ditto.
Italians	ditto.
Ancient Umbrians	at mid-day.
Ancient and modern Arabians	ditto.
Astronomers of all nations	ditto.
Ancient Egyptians	midnight.
English	ditto.
French	ditto.
Germans	ditto.
Dutch	ditto.
Russians	ditto.
Spaniards	ditto.
Swiss	ditto.
Portuguese	ditto.
Danes	ditto.
Swedes, Laplanders, Americans, and Araucanians	ditto.
Modern Chinese	ditto.

Subdivision of the day.

The subdivision of the day into particular parts has likewise been different among different nations. The Chaldeans, Syrians, Persians, Indians, Jews and Romans, divided both the day and night into four parts. The Greeks divided the natural day into 12 hours in imitation of the Babylonians, and this practice was afterwards adopted by the Romans. Among almost all modern nations, the day is divided into 24 hours, reckoned twice from 1 to 12, except among the Italians, Bohemians, and Poles, who reckon them from 1 to 24. The Araucanians divide the natural day into 12 parts, each of which has a particular name. The Turks follow the practice of the Jews; and the Chinese divide the mean solar day into 12 hours, each of which is of course equal to two of ours. In the decimal system adopted by the French, the day is divided into 10 hours.

The various methods which have been employed for measuring the subdivisions of the mean solar day by *Clepsydræ, Dials, Clocks, and Watches*, will be discussed under the articles DIALLING, HOROLOGY, HYDRODYNAMICS, and TIMEKEEPER.

SECT. II. *On the Month.*

On the month.

The next convenient division of time which is marked out by the revolutions of the heavenly bodies is the month. The *astronomical* month is the time in which the moon performs a complete revolution round the heavens, and is either *periodical* or *synodical*. The *periodical* month is the time in which the moon moves from one point of the heavens to the same point again, and is equal to $27^d\,7^h\,43'\,4''.7$; and the *synodical* month, or *lunation* as it is sometimes called, is that portion of time which elapses between two successive new moons, or between two successive conjunctions of the moon with the sun, and is equal to $29^d\,12^h\,44'\,3''\,11'''$. The *solar* month is that portion of time in which the sun moves through one sign of the ecliptic, and is equal at an average to $30^d\,10^h\,29'\,5''$. The *civil* month, which is formed for the purposes of civil life, is one, which consists of a certain number of whole days, and approaches as nearly as possible to the astronomical or to the solar month.

When the civil month approaches to the lunar month, it is called the civil lunar month, and generally contains 29 and 30 days alternately, with some corrections. This kind of month was used by the Jews, Greeks, and Romans, till the time of Julius Cæsar, who introduced the civil solar month, consisting of 30 and 31 days alternately.

In the following Tables, we have shewn the method of dividing the year into months, adopted by the Egyptians, Jews, Greeks, Romans, Arabs and Turks, and the French.

Egyptian months.

No. I. *Egyptian Months.*

No.	Names.	Signification.	Corresponding Months in our Calendar.		Number of days in each.
1	Thoth	Mercury	August	29	30
2	Paophi	Serpent	September	28	30
3	Athir	Venus	October	28	30
4	Chojac	Verdure	November	27	30
5	Tybi	Good month	December	27	30
6	Mechir	Venus	January	26	30
7	Phamenoth	Good moon	February	25	30
8	Parmuthi	Corn thrashed	March	27	30
9	Pachon	Hercules	April	26	30
10	Payni	The protector	May	26	30
11	Epiphi	Osiris	June	25	30
12	Mesori	Last month	July	25	30
	Epagomenæ or days added				5
	Number of days in the year				365

Jewish months.

No. II. *The Jewish Months.*

No.	Names.	Signification.	Corresponding Months in our calendar.	Number of days in each.
1	Tisri		Aug.—Sept.	30
2	Marchesvan	Great Ram	Sept.—Oct.	29
3	Casleau	Stormy weath.	Oct.—Nov.	30
4	Tebeth	Hope	Nov.—Dec.	29
5	Shebat	Repose	Dec.—Jan.	30
6	Adar	Purifying fire	Jan.—Feb.	29
7	Nisan or Abib	Standard	Feb.—March	30
8	Jiar	Wat. meadow	March—April	29
9	Sivan	Anim. in past.	April—May	30
10	Tamuz	The sun	May—June	29
11	Ab	Fruit	June—July	30
12	Elul	Vine press	July—August	29
	Number of days in the year			354

In the *Embolimic* year after the month *Adar* the Jews added a month of 30 days, called *Ve-Adar.*

Greek months.

No. III. *The Ancient Grecian Months.*

No.	Names.	Signification.	Corresponding Months in our Calendar.	Number of days.
1	Hecatombæon	The names of the Greek months are derived from the names of the festivals which were celebrated in each.	June—July	30
2	Metagitnion		July—Aug.	29
3	Boedromion		Aug.—Sept.	30
4	Pyanepsion		Sept.—Oct.	29
5	Maimacterion		Oct.—Nov.	30
6	Posideon		Nov.—Dec.	29
7	Gamelion		Dec.—Jan.	30
8	Anthesterion		Jan.—Feb.	29
9	Elaphebolion		Feb.—March	30
10	Municheon		March—April	29
11	Thargelion		April—May	30
12	Schirrophorion		May—June	29
	Number of days in the year			354

Roman months.

No. IV. *Roman Months before the reformation of the Calendar.*

Roman names.	Number of days.	English names.
Januarius	29	January
Februarius	28	February
Martius	31	March
Aprilis	29	April
Maius	31	May
Junius	29	June
Quintilis, afterwards Julius	31	July
Sextilis, afterwards Augustus	at first 29 afterwards 31	August
September	29	September
October	31	October
November	29	November
December	29	December

Arabic and Turkish months.

No. V. *Arabic and Turkish Months.*

No.	Names.	Signification.	Corresponding Months in our Calendar.		Number of days in each.
1	Muharram	Sacred month	July	16	30
2	Saphar	Month of study	August	15	29
3	Rabia I.	Honoured month	September	13	30
4	Rabia II.	Id.	October	13	29
5	Jomada I.	Month of prayer	November	11	30
6	Jomada II.	Id.	December	11	29
7	Rajab		January	9	30
8	Shasban	Month of hope	February	8	29
9	Ramadam	Month of heat	March	9	30
10	Shawal		April	8	29
11	Dulhaadah	Month of repose	May	7	30
12	Dulheggia	Month of ceremonies	June	5	29
	Number of days in the year				354

The Arabians add 11 days at the end of every year to preserve a coincidence between the months and the seasons.

French months.

No. VI. *French Months.*

Names.	Signification.	Corresponding Months in our Calendar.		Number of days in each.
Vendemiare	Vintage month	September	23	30
Brumaire	Foggy month	October	23	30
Frimaire	Sleety month	November	22	30
Nivose	Snowy month	December	23	30
Pluviose	Rainy month	January	21	30
Ventose	Windy month	February	20	30
Germinal	Budding month	March	22	30
Floreal	Flowery month	April	21	30
Prairial	Meadow month	May	21	30
Messidor	Harvest month	June	20	30
Thermidor	Hot month	July	20	30
Fructidor	Fruit month	August	19	30
Number of days				360

As the French months consist of 30 days each, making in all 360 days, the remaining 5 days are called *complementary days,* and *sans culottides,* the first of which is the 18th September, the second the 19th, the third the 20th, the fourth the 21st, and the fifth the 22d of September, which terminates the French year.

Each month is divided into three decades, consisting of 10 days each, which are called *primidi, duodi, tridi, quartidi, quintidi, sextidi, septidi, octodi, nonodi,* and *decadi.* For an account of the French year, and their method of intercalation, see Section III. *On the Year.*

Greek months. As the Grecian months consisted of 30 and 29 days alternately, the former were called πληρεις, *full*, and δεκαφθινοι, as ending on the 10th day; while the latter received the name of κοιλοι, or *hollow*, and εναφθινοι, or terminating on the 9th day. They divided each month into three decades of days, (τρια δεκημερα,) which received the following names:

First decade was called μηνος αρχομενου, or ισταμενου.
Second, ... μηνος μεσουντος.
Third, ... μηνος φθινοντος, απιοντος, παυομενου,
or ληγοντος.

Hence the days of the month were reckoned in the following manner:

1st day of 1st decade, was called νουμηνια, as falling on the day of new moon, or πρωτη αρχομενου, or ισταμενου.
2d day, ... δευτερα ισταμενου.
3d day, ... τριτη ισταμενου.
And so on with the rest down to the 10th, or δεκατη ισταμενου.
1st day of 2d decade, which was the 11th of the month, was called . . . . πρωτη μεσουντος, or πρωτη επι δεκα.
2d day, ... δευτερα μεσουντος, or επι δεκα.
And so on with the rest to the εικας, or 20th.
1st day of the 3d decade, was called πρωτη επ᾽ εικαδι.
2d day, ... δευτερα επ᾽ εικαδι
And so on with the rest.

Sometimes the Greeks inverted the numbers, and called the first day φθινοντος, or απιοντος δεκατη, the second day φθινοντος ενατη, and so on to the last day of the month, which had the name of Δημητριας, from Demetrius Poliorcetes. This day was also called τριακας, the thirtieth; and, in the laws of Solon, it is named ενη και νεα, *the old and new*, as part of it belonged to the old moon, and part of it to the new one, which happened upon that day.

Roman months. Before the reformation of the Roman calendar by Julius Cæsar, the Romans divided their months into kalends, nones, and ides. The name kalends, derived from the old word *calo*, to call, was given to the first day of every month, because, before the fasts were published, the pontiff assembled the people in the capitol, and proclaimed with a loud voice the number of the kalends, or the days on which the nones should happen. The formula *Calo Juno Novella*, was repeated as often as there were days in the kalends. The term *nones*, applied to the 5th day of those months that have 29 days, and to the 7th of those that have 31 days, is derived from *nonus*, the ninth, and was used, because they always happened 9 days before the ides. The *ides*, which fell on the 13th of those months that have 29 days, and the 15th of those that have 31 days, is derived from *iduare*, to divide, and was applied to the third division of the Roman months, because it divided the month nearly into two parts.

Hence there were in months

Of 29 days,	Of 30 days,	Of 31 days,
1 day of kalends,	1 day of kalends,	1 day of kalends,
4 . . . . . of nones,	4 . . . . . . of nones,	6 . . . . . . of nones,
8 . . . . . of ides,	8 . . . . . . of ides,	8 . . . . . . of ides,
16 called the kalends of the following month,	17 called the kalends of the following month,	16 called the kalends of the following month,
29 days.	30 days.	31 days.

The method of naming the days of each month will be apparent from the following Table, which is for January, a month of 29 days.

Roman Calendar.

Number of Days in the Month.	Names given to the Days of the Month by the Romans.	General Division of the Month.
1	KALENDUS JANUARII.	One day of Kalends.
2	IV. Nonas.	4 days of Nones.
3	III. Nonas.	
4	Pridie Nonas.	
5	NONAS JANUARII.	
6	VIII. Idus.	8 days of Ides.
7	VII. Idus.	
8	VI. Idus.	
9	V. Idus.	
10	IV. Idus.	
11	III. Idus.	
12	Pridie Idus.	
13	IDUS JANUARII.	
14	XVII. Kal Februarii.	16 days of Kalends.
15	XVI. Kal. Feb.	
16	XV. Kal. Feb.	
17	XIV. Kal. Feb.	
18	XIII. Kal. Feb.	
19	XII. Kal. Feb.	
20	XI. Kal. Feb.	
21	X. Kal. Feb.	
22	IX. Kal. Feb.	
23	VIII. Kal. Feb.	
24	VII. Kal. Feb.	
25	VI. Kal. Feb.	
26	V. Kal. Feb.	
27	IV. Kal. Feb.	
28	III. Kal. Feb.	
29	Pridie Kal. Februarii.	

At the reformation of the calendar by Julius Cæsar, of which we shall soon give a full account, two days were added to the months of January, August, and December, and one to April, June, September, and November. The stile of the calendar, engraved on a square piece of marble, was then exposed every month in the principal public places, for the information of the people. The following example for January may be interesting to some of our readers.

MENSIS
JANUARIUS,
DIES. XXXI.,
NON. QUINT.
DIES. HOR. VIIII. s.
NOX. HOR. XIIII. s.
SOL
CAPRICORNO,
TUTELA
JUNONIS.
PALUS
ACUITUR,
SALIX
HARUNDO
CÆDITUR;
SACRIFICAT
DIIS
PENATIBUS.

Weeks. The subdivision of the month into weeks is very ancient, and has been adopted by almost all nations, excepting the ancient Greeks, the inhabitants of the north of China, the Persians, and the Mexicans. It originated with the ancient Chaldeans, who gave the name of one of the seven planets to each hour of the day, and designated each day by the name of that planet which corresponded with the first hour of the day. In consequence of this arrangement, it necessarily happened, that each day of the week was marked by the name of the planet which it now bears. In order to understand this, the order of the planets must be given upon the Ptolemaic system. Thus,

1. Saturn.
2. Jupiter.
3. Mars.
4. Sun.
5. Venus.
6. Mercury.
7. Moon.

As the day was divided into 24 hours, and as every hour was called after one of the planets in their order, the planets would be numbered *three* times in the first day, and the three first planets four times. Thus,

Origin of the names given to the days of the week.

Therefore the fourth planet, or the *Sun*, will belong to the first hour of the second day, and will consequently be the name of that day. . . . . $7+7+7+3$

During the second day, we have . . . $4+7+7+6$

From which it follows that the seventh planet, or the *Moon*, will commence the third day.

During the third day, we have . . $1+7+7+7+2$

Hence the 3d planet, or *Mars*, will mark the first hour of the fourth day.

During the fourth day, we have . . . $5+7+7+5$

Hence the 6th planet, or *Mercury*, will designate the 1st hour of the 5th day.

During the fifth day, we have . . $2+7+7+7+1$

Hence the 2d planet, or *Jupiter*, will mark the first hour of the 6th day.

During the 6th day we have . . . . $6+7+7+4$

Hence the 5th planet, or *Venus*, will mark the 1st hour of the 7th day.

During the seventh day, we have . . . $3+7+7+7$

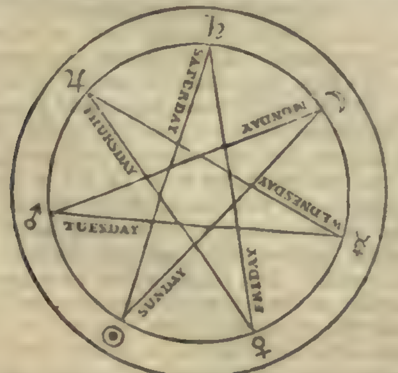
Consequently the first planet, or *Saturn*, will mark the 1st hour of the eighth day, and so on with the rest, the same planets marking the same days of every weekly period.

Hence we have the following arrangement:

1st day of the week Saturday, or the day of Saturn.
2d . . . . Sunday, ... day of the Sun.
3d . . . . Monday, ... day of the Moon.
4th . . . . Tuesday, ... day of Mars.
5th . . . . Wednesday, ... day of Mercury.
6th . . . . Thursday, ... day of Jupiter.
7th . . . . Friday, ... day of Venus.

This order of the days, first adopted by the Chaldeans, was preserved by the Mosaic law. The Christians, however, began their week on Sunday, and the Mahometans on Friday.

The denomination of the days of the week has also been explained by the following diagram, in which the seven planets are placed in their order round the circle.



At the mark ♄, or Saturday, the line directs us to ☉, or Sunday, which again directs us to ☽, or Monday, then to ♂, or Tuesday, from which we are led to ☿, or Wednesday, and from this to ♃, or Thursday, which conducts us to ♀, or Friday.

SECT. III. *On the Year and the Reformation of the Calendar.*

The next and most important chronological period indicated by the celestial motions is the year.

Solar year.

The *solar* or *tropical* year, is that period which corresponds to the sun's revolution in the ecliptic from any equinox or solstice to the same again, and consists of 365 days $5^h\ 48'\ 54''$.

Sidereal year.

The *sidereal year*, is that portion of time which corresponds to the revolution of the sun from any fixed star to the same star again, and is equal to 365 days $6^h\ 9'\ 15''$, or $20'\ 21''$ shorter than the solar year.

Lunar year.

The *lunar year* is equal to twelve revolutions of the moon from the sun to the sun again, or from one conjunction with the sun to the next conjunction. It contains 354 days $8^h\ 48'\ 36''$, and is 10 days $21^h\ 0'\ 18''$ shorter than the solar year.

Civil year.

The *civil year* is that which is used for the purposes of civil life.

In the earliest periods of society, the most barbarous nations could not fail to observe a regular return of the seasons; and the necessity of providing against the inclemency of winter, or the burning heat of the summer season, must have compelled them to ascertain, in a rude manner, the length of the year. The period in which the seasons returned would probably be measured at first by the motions of the moon, and be reckoned equivalent to 12 of her monthly revolutions. Hence a year of 12 lunations would be formed, each of which consisted of 30 days, forming the lunisolar year of 360 days. This form of the year was adopted by the Chaldeans, Egyptians, and Indians, and was in use among almost all the nations of antiquity. As the true solar year, however, of 365 days $5^h\ 48'\ 54''$ exceeded the lunisolar year by about 5¼ days, the seasons would rapidly deviate from the months to which they at first corresponded, and in the short space of 34 years, the winter would happen in those months which formerly corresponded with the summer season. This enormous aberration was observed by almost all nations, and was corrected by the addition of a few intercalary days at certain intervals. By this means, independent of astronomical observation, the length of the solar year would soon be found to consist of 365 days. The Egyptians were very early acquainted with the year of 365 days. The Theban priests ascribed the invention of it to Mercury or Thoth; and it seems to have been known in the 12th or 13th century before the Christian æra.

Canicular year.

As the inundation of the Nile was annually announced by the heliacal rising of Sirius, which was made to correspond with the beginning of the year, it was soon discovered that the heliacal rising of this star advanced nearly one day in four years, and that in the space of 1461 years it would complete a whole revolution till it again happened on the day originally fixed for the commencement of the year. This period, which was equal to 1460 Julian years, was called the Great Egyptian or Canicular Year.

Reformation of the calendar.

It is impossible to ascertain the time when the true solar year was discovered. The Theban priests lay claim to the discovery, and the knowledge of it is said to have been introduced into Greece by Plato and Eudoxus, who obtained it as a secret from the Egyptians; but at whatever time this knowledge was obtained, it does not appear to have been employed for the purpose of adjusting the civil with the solar year, till the time of Numa Pompilius.

Romulus divided the year into 10 months or 304 days, March, May, Quintilis, and October having 31 days, and the rest 30: He made it commence on the first of March; but there is no evidence for believing that any method was adopted for reconciling this singular calendar with the return of the seasons.

Changes made upon the calendar by Numa.

With the view of making a complete lunar year of 354 days, Numa added 50 days to the 304 days or 10 months of Romulus. He borrowed one day from each of the months of 30 days, and out of these 56 supernumerary days he formed the months of January and February. In order to make the number of days in the year 355 a lucky number, he added one day to January, and transferred the beginning of the year to the first of January, February being placed at the end of the year. As the year of 355 days is 11¼ shorter than the solar year, the excess of the latter amounted in 8 years to 90, and accordingly this number of days was intercalated every 8 years. They were formed into four months of 22 and 23 days alternately, and one of these months was intercalated every two years, thus

In the first 2 years, 22 days were added to the second year.
In the next 2 years, 23 . . . . fourth year.
2 years, 22 . . . . sixth year.
2 years, 23 . . . . eighth year.
$\overline{90}$

But since the excess of the solar year above 365 days is here assumed at 6 hours instead of $5^h\ 48'\ 45''$, the intercalations were too great by 8 days $1^h\ 27'\ 56''$. To remedy this defect, 66 days instead of 90 were to be added in every third octennial period, or 3 months of 22 days each. This addition was still too great by $4^h\ 28'\ 20''$, but the calendar thus rectified was sufficiently correct for all the purposes of civil life.

Reformation of the calendar by Julius Cæsar.

From the negligence of the pontiffs, however, to whom the duty of intercalation was confided, the supernumerary months were not properly applied; and in the time of Julius Cæsar the civil had receded from the solar year by no less than 90 days. With the assistance and advice of Sosigenes, Julius Cæsar undertook, B. C. 46, the formation of a new calendar. In order to include the 90 days which had been lost, he formed a year of 355+90=445 days or 15 months; and this year, which was called the year of confusion, terminated on the day preceding the first of January B. C. 46, in which the Julian year commenced. The 10 days which the year of Numa fell short of the solar year, were included by adding one day to January, August, and December, and one to April, June, September, and November, and the year was thus made to consist of 365 days. The excess of six hours, which amounted to one day in four years, was taken into account by making every fourth year consist of 366 days. This intercalary day was added to the 23d of February, that is, the 24th day, or the 6th of the calends of March, was twice counted. Hence the year of 366 days was called *Bissextile* by the Romans; and it has very improperly received the name of *Leap year* in this country, an appellation which might have been more appropriate had it consisted of 364 days.

Reformation of the calendar by Pope Gregory.

This correction of the calendar, though extremely simple and ingenious, was still imperfect, as it was founded on the supposition that the solar year consisted of 365 days 6 hours, instead of 365 days $5^h\ 48'\ 45\frac{1}{2}''$. The difference between the one employed by Julius Cæsar, and the true solar year was therefore $11'\ 14\frac{1}{2}''$, which amounted to a whole day in 130 years. This imperfecion in the Julian calendar was first noticed by the venerable Bede in 730; and at the Council of Nice, which met in 325, the vernal equinox, which happened on the 25th of March, in the time of Julius Cæsar, had receded to the 21st of March, where it was fixed by the council. The necessity of some change in the calendar was now obvious, and attempts were made at different times to accomplish this desirable object; but it was not till near the close of the 16th century that a complete reformation was effected by Pope Gregory XIII. The most learned astronomers and mathematicians of the age were invited to Rome to consider this important subject, and after it had undergone a discussion of ten years, the plan proposed by two brothers, Aloisius and Antoninus Lilius, from Verona, was ultimately preferred. Copies of this plan were sent to all Catholic states, academies, &c. in A. D. 1577, and in March 1582, a brief was published, abrogating the ancient calendar, and substituting in its room the new *Gregorian Calendar*.

In the year 1582, the vernal equinox had receded ten days since the Council of Nice, and happened on the 11th instead of the 21st of March. It was therefore decreed, that the vernal equinox should be brought back to the 21st of March as in the year 325, and that for this purpose ten days should be taken from the month of October 1582. In order to avoid any future deviation of the civil from the solar year, it was determined that instead of every 100th or centurial year being a leap year, every 400th year only should be a leap year. By this means the excess of the civil Julian year of 365 days 6 hours above the tropical or solar year of 365 days $5^h\ 48'\ 45\frac{1}{2}''$ was taken into account, and in the course of 5000 years the error of this method of intercalation does not exceed one day and a half to be suppressed.

The calendar thus reformed was immediately introduced into all Catholic countries, viz. Spain, Portugal, and part of Italy; but it was not received in France till December, when the 10th was reckoned the 20th of the month. The German Catholic states adopted the new calendar in 1583; but the Protestants, actuated by a mean and unworthy jealousy, declined to receive a measure which originated among the Catholics. Time, and the progress of liberal sentiment, however, gradually removed their objections, and in the year 1700 the Protestant states in Germany adopted the Gregorian calendar. In 1752, an act of parliament was passed in this country, by which the 3d of September was reckoned the 14th; and in 1753 the new style was introduced into Denmark and Sweden. The Russians, however, still reckon by the old style; but from the important events which are now passing in Europe, it is probable that this great empire will conform to the usages of all civilized nations.

French calendar.

The zeal for innovation which accompanied the French revolution, induced them to change their calendar along with their government. It was decreed by the convention, that the vulgar æra should be abolished in all civil concerns; that the new French æra should be reckoned from the foundation of the republic Sept. 22. 1792 of the vulgar æra, on the day of the true autumnal equinox, when the sun entered Libra at $9^h\ 18'\ 30''$ in the morning, according to the meridian of Paris; that each year should begin at the midnight of the day on which the true autumnal equinox falls; and that the first year of the French republic had begun on the midnight of the 22d September, and terminated on the midnight between the 21st and 22d September 1793. In order to effect a correspondence between the seasons and the civil year, it was decreed that the 4th year of the republic should be the first *sextile*, or leap year; that a sixth complementary day should be added to it; and that it should terminate the first *franciade*; that the sextile, or leap year, should take place every 4 years, and should mark the close of each franciade; that the 1st, 2d, and 3d centurial years, viz. 100, 200, and 300 of the republic, should be common, and that the 4th, viz. 400, should be sextile; and that this should be the case every 4 centuries till the 40th, which should terminate with a common year.

Table of the times at which different nations began the year.

The following Table shews the various Times at which different Nations have begun the Civil Year.

Names of the Nations.	Time when the Year begins.
Egyptians, . . .	Autumnal equinox.
Chaldeans, . . .	Id.
Persians, ...	Id.
Syrians, ...	Id.
Phenicians, . . .	Id.
Carthaginians,	Id.
Jews, ...	Id. for their civil year.
——	Vernal equinox for their ecclesiastical year.
Greeks, ...	Winter solstice before the time of Meton.
——	Summer solstice after Meton.
——	Vernal equinox in the time of Romulus.
Romans, ...	Winter solstice in the time of Numa Pompilius.
Scandinavians,	Winter solstice.
Ancient and modern Chinese,	With the first new moon which appears after the sun is in the 1st of Aquarius.
English, ...	Winter solstice.
French, ...	At St Martin's. This was used by the Monks at a very early period.
——	On the 1st May under the 1st race of kings.
——	Winter solstice under the 2d race of kings.
——	Vernal equinox, under the 3d race of kings.
——	Winter solstice, by an ordonnance of Charles IX. 1564.
——	Autumnal equinox, since the establishment of the republican æra.
Spaniards, . . .	Winter solstice.
Portuguese, . .	Do.
Dutch, ...	Do.
Germans, . . .	Do.
Siamese, ...	Do.
Peruvians, . . .	Do.
Americans, . .	Do.
Mexicans, . . .	Vernal equinox.
Venetians, Florentines, Pisans, and inhabitants of Treves, . .	Vernal equinox.
American Indians,	First new moon of the vernal equinox.
Turks and Arabs,	16th of July.
Japanese, . . .	New moon nearest to the winter solstice.
Araucanians, . .	22d December at the winter solstice.

SECT. IV. *On Cycles.*

On cycles.

A *cycle*, derived from the Greek word κυκλος, a *circle*, is a circulating period of time, at the expiration of which certain celestial phenomena return in the same order.

The *Metonic cycle*, or the lunar cycle of Meton, is a period of 19 solar years, or 6940 days, in which the conjunctions, and oppositions, and other aspects of the moon, are within an hour of being the same as they were on the same days of the month nineteen years before. This cycle was adopted on the 16th of July, B.C. 433. As the scheme of the festivals was inscribed by the Greeks on a marble pillar in letters of gold, the current year of this cycle was called the Golden Number. The Metonic cycle, though remarkably simple, is nevertheless far from being exact. A period of 6940 days exceeds 19 solar years by 9½ hours, and 235 lunations by 7½ hours, and these deviations would, in the course of 4 cycles, or 76 years, amount to more than a day. In consequence of this defect, Calippus, who lived about a century after Meton, proposed a new cycle of 27,759 days, which is nearly equal to 76 solar years and 940 lunations. This cycle, which supposes the tropical year to be 365¼ days, anticipates the full moons only $5^{h}\ 53'$ in 76 years.

In order to find the golden number, or the current year of the lunar cycle, we must consider that the year of our Saviour's birth, according to the vulgar æra, was the first year of the lunar cycle; and, therefore, if we add one to the year of Christ, for which the golden number is required, and divide the sum by 19, the quotient will be the number of cycles which have elapsed since the birth of Christ, and the remainder will be the golden number or the current year of the cycle. If there is no remainder, the cycle is 19.

The following Table shews the golden number for 4000 years after the Christian æra. By entering the Table on the left hand with the even number of years in the given year, and at the head of the Table with the years less than 100, the golden number will be found at the angle where the columns meet. Thus, if the golden number is required for the year 1820, we look for 1800 at the left side, and for 20 at the top, and at the angle we find 16, which is the golden number for that year.

Table I. *Shewing the Golden Number, or current year of the Lunar Cycle, which is the same both in the Old and New Stile, from the Birth of Christ to A. D. 4000.*

Hundreds of Years.			Years less than an Hundred.																		
			0 19 38 57 76 95	1 20 39 58 77 96	2 21 40 59 78 97	3 22 41 60 79 98	4 23 42 61 80 99	5 24 43 62 81	6 25 44 63 82	7 26 45 64 83	8 27 46 65 84	9 28 47 66 85	10 29 48 67 86	11 30 49 68 87	12 31 50 69 88	13 32 51 70 89	14 33 52 71 90	15 34 53 72 91	16 35 54 73 92	17 36 55 74 93	18 37 56 75 94
0	1900	3800	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
100	2000	3900	6	7	8	9	10	11	12	13	14	15	16	17	18	19	1	2	3	4	5
200	2100	4000	11	12	13	14	15	16	17	18	19	1	2	3	4	5	6	7	8	9	10
300	2200	—	16	17	18	19	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
400	2300	—	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	1
500	2400	—	7	8	9	10	11	12	13	14	15	16	17	18	19	1	2	3	4	5	6
600	2500	—	12	13	14	15	16	17	18	19	1	2	3	4	5	6	7	8	9	10	11
700	2600	—	17	18	19	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
800	2700	—	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	1	2
900	2800	—	8	9	10	11	12	13	14	15	16	17	18	19	1	2	3	4	5	6	7
1000	2900	—	13	14	15	16	17	18	19	1	2	3	4	5	6	7	8	9	10	11	12
1100	3000	—	18	19	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1200	3100	—	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	1	2	3
1300	3200	—	9	10	11	12	13	14	15	16	17	18	19	1	2	3	4	5	6	7	8
1400	3300	—	14	15	16	17	18	19	1	2	3	4	5	6	7	8	9	10	11	12	13
1500	3400	—	19	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1600	3500	—	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	1	2	3	4
1700	3600	—	10	11	12	13	14	15	16	17	18	19	1	2	3	4	5	6	7	8	9
1800	3700	—	15	16	17	18	19	1	2	3	4	5	6	7	8	9	10	11	12	13	14

The following Table is useful for finding the time of new moon from the golden number. It is suited to the new stile, and principally to the second year after leap year, and will serve till A. D. 1900. In order, therefore, to find the day of new moon for any month of a given year before A. D. 1900, we have only to look for the golden number under the given month, and opposite to it, on the left hand column, will be found the time of new moon. Thus, if we require the time of new moon in June 1820, we find, from the preceding Table, that the golden number for that year is 16, and opposite to this number, in the column for June, will be found the 10th day of the month.

Table II. *Shewing the time of New Moon from the Golden Number, till the year A. D. 1900.*

Days.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	9		9	17	17	6				11		19
2		17			6	14	14	3	11		19	
3	17	6	17	6			3	11		19	8	8
4	6		6	14	14	3			19	8		16
5		14			3	11	11	19	8		16	
6	14	3	14	3			19			16	5	5
7	3		3	11	11	19		8	16			13
8		11			19	8	8	16	5	5	13	
9	11	19	11	19						13		2
10			19	8	8	16	16	5	13		2	10
11	19	8					5	13	2	2	10	
12	8	16	8	16	16	5				10		18
13					5	13	13	2	10		18	7
14	16	5	16	5			2	10	18	18	7	
15	5		5	13	13	2				7		15
16		13			2	10	10	18	7		15	
17	13	2	13	2			18	7		15	4	4
18	2		2	10	10	18			15			12
19		10			18	7	7	15	4	4	12	
20	10	18	10	18			15			12	1	1
21	18		18	7	7	15		4	12			9
22		7			15	4	4	12	1	1	9	
23	7	15	7	15			12			9	17	17
24			15	4	4	12		1	9			6
25	15	4			12		1	9	17	17	6	
26	4		4	12		1				6		14
27		12		1	1	9	9	17	6		14	
28	12	1	12		9		17	6	14	14	3	3
29	1		1	9		17				3		11
30					17	6	6	14	3		11	
31	9		9				14	3		11		19

The following Table is for the same purpose as the preceding, and is used in the same manner, but is adapted for years between A. D. 1900 and A. D. 2119.

Table III. *Shewing the time of New Moon corresponding to the Golden Number, between the years A. D. 1900 and A. D. 2199.*

Days.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		9		17	17	6		14	3		11	
2	9	17	9		6					11		19
3	17	6	17	6		14	14	3	11		19	
4	6		6				3	11		19	8	8
5				14	14	3			19	8		16
6		14			3	11	11	19	8		16	
7	14	3	14	3			19			16	5	5
8	3		3	11	11	19		8	16			13
9		11			19	8	8	16	5	5	13	
10	11	19	11	19						13		2
11			19	8	8	16	16	5	13		2	10
12	19	8					5	13	2	2	10	
13	8	16	8	16	16	5				10		18
14					5	13	13	2	10		18	7
15	10	5	16	5			2	10	18	18	7	
16	5		5	13	13	2						15
17		13			2	10	10	18	7		15	
18	13	2	13	2			18	7		15	4	4
19	2		2	10	10	18			15			12
20		10			18	7	7	15	4	4	12	
21	10	18	10	18			15			12	1	1
22	18		18	7	7	15		4	12			9
23		7			15	4	4	12	1	1	9	
24	7	15	7	15			12		9	9	17	17
25			15	4	4	12		1	17	17	6	6
26	15	4			12		1	9		6		
27	4		4	12		1	9	17	6			14
28		12		1	1	9	17	6				
29	12	1	12		9	17			14	14	3	3
30	1		1	9	17	6	6			3		11
31			9					14	2		11	

Solar cycle.

The *solar cycle* is a period of 28 years, at the end of which the days of the week correspond to the same days of the month.

Dominical letter.

The first seven letters of the alphabet A, B, C, D, E, F, G, have been employed by chronologers to mark the several days of the week, the first letter standing for the first of January and so on; and since one of these letters must necessarily stand opposite to Sunday, it is called the *dominical letter,* or Sunday letter, and is printed in a capital form, the other six letters, which designate the other six days of the week, being printed in small characters. Then, since a Julian year of 365 days contains 52 weeks and one day, it is obvious that the year must begin and end on the same day of the week, and consequently the next year must commence on the day following. Had there been only 52 weeks in the common year, without any days remaining, the year would have constantly begun on the same day of the week. When January, therefore, begins on Sunday, the dominical letter for that year is A, and since the next year must begin on Monday, Sunday will be the 7th day, to which the letter G is annexed, which will therefore be the dominical letter for that year. The third year will begin on Tuesday, and as Sunday falls on the sixth day, F will be the dominical letter. Hence it follows that the dominical letters will succeed each other in a retrograde order, viz. G, F, E, D, C, B, A, and if there was no leap year, the same days of the week would, in the course of *seven* years, return to the same days of the month. But since leap year contains 52 weeks, and two days over, any leap year beginning on Sunday, will end on Monday, and the following year will begin on Tuesday, the first Sunday of which must fall on the sixth of January, to which the dominical letter F corresponds, and not G as in common years. As the leap year returns every fourth year, the regular succession of the dominical letter is interrupted, and does not return to its former state till after 7 × 4, or 28 years; when the same days of the week will correspond with the same days of the month as formerly.

The following Tables contain the dominical letters both for the old and new stile, and will be understood from the annexed example.

Example. *Let it be required to find the dominical letter for the year* 150 *before Christ.* Subtract one from the given year, which leaves 149, and it will be found from entering Table IV. with the 100 years at the head, and the 49 at the side, that A is the dominical letter required.

Table IV. *Containing the Dominical Letters for 4200 Years before the Christian Æra. Old Stile.*

Years by which the given year exceeds the hundreds of years.				Hundreds of Years before Christ.						
				0	100	200	300	400	500	600
				7000	800	900	1000	1100	1200	1300
				1400	1500	1600	1700	1800	1900	2000
				2100	2200	2300	2400	2500	2600	2700
				2800	2900	3000	3100	3200	3300	3400
				3500	3600	3700	3800	3900	4000	4100
0	28	56	84	D C	C B	B A	A G	G F	F E	E D
1	29	57	85	E	D	C	B	A	G	F
2	30	58	86	F	E	D	C	B	A	G
3	31	59	87	G	F	E	D	C	B	A
4	32	60	88	B A	A G	G F	F E	E D	D C	C B
5	33	61	89	C	B	A	G	F	E	D
6	34	62	90	D	C	B	A	G	F	E
7	35	63	91	E	D	C	B	A	G	F
8	36	64	92	G F	F. E	E D	D C	C B	B A	A G
9	37	65	93	A	G	F	E	D	C	B
10	38	66	94	B	A	G	F	E	D	C
11	39	67	95	C	B	A	G	F	E	D
12	40	68	96	E D	D C	C B	B A	A G	G F	F E
13	41	69	97	F	E	D	C	B	A	G
14	42	70	98	G	F	E	D	C	B	A
15	43	71	99	A	G	F	E	D	C	B
16	44	72		C B	B A	A G	G F	F E	E D	D C
17	45	73		D	C	B	A	G	F	E
18	46	74		E	D	C	B	A	G	F
19	47	75		F	E	D	C	B	A	G
20	48	76		A G	G F	F E	E D	D C	C B	B A
21	49	77		B	A	G	F	E	D	C
22	50	78		C	B	A	G	F	E	D
23	51	79		D	C	B	A	G	F	E
24	52	80		F E	E D	D C	C B	B A	A G	G F
25	53	81		G	F	E	D	C	B	A
26	54	82		A	G	F	E	D	C	B
27	55	83		B	A	G	F	E	D	C

Table V. *Containing the Dominical Letters for 4200 Years after the Christian Æra, old Stile.*

Years by which the given year exceeds the hundreds of years.	Hundreds of Years after Christ. 0 700 1400 2100 2800 3500	100 800 1500 2200 2900 3600	200 900 1600 2300 3000 3700	300 1000 1700 2400 3100 3800	400 1100 1800 2500 3200 3900	500 1200 1900 2600 3300 4000	600 1300 2000 2700 3400 4100
0 28 56 84	D C	E D	F E	G F	A G	B A	C B
1 29 57 85	B	C	D	E	F	G	A
2 30 58 86	A	B	C	D	E	F	G
3 31 59 87	G	A	B	C	D	E	F
4 32 60 88	F E	G F	A G	B A	C B	D C	E D
5 33 61 89	D	E	F	G	A	B	C
6 34 62 90	C	D	E	F	G	A	B
7 35 63 91	B	C	D	E	F	G	A
8 36 64 92	A G	B A	C B	C D	E D	F E	G F
9 37 65 93	F	G	A	B	C	D	E
10 38 66 94	E	F	G	A	B	C	D
11 39 67 95	D	E	F	G	A	B	C
12 40 68 96	C B	D C	E D	F E	G F	A G	B A
13 41 69 97	A	B	C	D	E	F	G
14 42 70 98	G	A	B	C	D	E	F
15 43 71 99	F	G	A	B	C	D	E
16 44 72	E D	F E	G F	A G	B A	C B	D C
17 45 73	C	D	E	F	G	A	B
18 46 74	B	C	D	E	F	G	A
19 47 75	A	B	C	D	E	F	G
20 48 76	G F	A G	B A	C B	D C	E D	F E
21 49 77	E	F	G	A	B	C	D
22 50 78	D	E	F	G	A	B	C
23 51 79	C	D	E	F	G	A	B
24 52 80	B A	C B	D C	E D	F E	G F	A G
25 53 81	G	A	B	C	D	E	F
26 54 82	F	G	A	B	C	D	E
27 55 83	E	F	G	A	B	C	D

Use of Table V.

Example. *Let it be required to find the dominical letter for* 1820, *old stile.* By looking for 1800 at the top of Table V. and 20 at the side, and guiding the eye to the angle of the column, D and C will be found to be the dominical letters for that year. Hence this year is leap year, which has always two dominical letters.

Table VI. *Containing the Dominical Letters for 4000 Years after the Christian Æra, new Stile.*

Years by which the given year exceeds the hundreds of years.	Hundreds of Years after Christ. 100 500 900 1300 1700 2100 2500 2900 3300 3700	200 600 1000 1400 1800 2200 2600 3000 3400 3800	300 700 1100 1500 1900 2300 2700 3100 3500 3900	400 800 1200 1600 2000 2400 2800 3200 3600 4000
	C	E	G	B A
1 29 57 85	B	D	F	G
2 30 58 86	A	C	E	F
3 31 59 87	G	B	D	E
4 32 60 88	F E	A G	C B	D C
5 33 61 89	D	F	A	B
6 34 62 90	C	E	G	A
7 35 63 91	B	D	F	G
8 36 64 92	A G	C B	E D	F E
9 37 65 93	F	A	C	D
10 38 66 94	E	G	B	C
11 39 67 95	D	F	A	B
12 40 68 96	C B	E D	G F	A G
13 41 69 97	A	C	E	F
14 42 70 98	G	B	D	E
15 43 71 99	F	A	C	D
16 44 72	E D	G F	B A	C B
17 45 73	C	E	G	A
18 46 74	B	D	F	G
19 47 75	A	C	E	F
20 48 76	G F	B A	D C	E D
21 49 77	E	G	B	C
22 50 78	D	F	A	B
23 51 79	C	E	G	A
24 52 80	B A	D C	F E	G F
25 53 81	G	B	D	E
26 54 82	F	A	C	D
27 55 83	E	G	B	C
28 56 84	D C	F E	A G	B A

Use of Table VI.

Example. *To find the dominical letter for the year* 1820, *new stile.* Enter Table VI. with 1800 at the head, and 20 at the side, and at the angle of the column will be found B A, the two dominical letters for that leap year.

The following Table is intended to shew the day of the month corresponding to any day of the week, or the day of the week corresponding to any day of the month for any year past or future.

TABLE VII. *Exhibiting the Days of the Months by the Dominical Letters, both for the Old and the New Stile.*

	Dominical Letters.						
Days of the Week.	A	B	C	D	E	F	G
	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
January 31	15	16	17	18	19	20	21
October 31	22	23	24	25	26	27	28
	29	30	31				
				1	2	3	4
	5	6	7	8	9	10	11
Feb. 28, 29	12	13	14	15	16	17	18
March 31	19	20	21	22	23	24	25
November 30	26	27	28	29	30	31	
							1
	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
April 30	16	17	18	19	20	21	22
July 31	23	24	25	26	27	28	29
	30	31					
			1	2	3	4	5
	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
August 31	20	21	22	23	24	25	26
	27	28	29	30	31		
						1	2
	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
September 30	17	18	19	20	21	22	23
December 31	24	25	26	27	28	29	30
	31						
		1	2	3	4	5	6
	7	8	9	10	11	12	13
	14	15	16	17	18	19	20
May 31	21	22	23	24	25	26	27
	28	29	30	31			
					1	2	3
	4	5	6	7	8	9	10
	11	12	13	14	15	16	17
June 30	18	19	20	21	22	23	24
	25	26	27	28	29	30	

Use of Table VII.

The dominical letter for the given year being found from the preceding Tables, enter Table VII. with this letter at the head, and all the days in the column immediately below it will be Sundays; the days in the column on the right hand, if there is a right hand column, will be Mondays; and the days in the column on the left hand, if there is a left hand column, will be Saturdays; and so on with the rest.

On the epact.

The epact is the excess of the solar above the lunar year, or the number of days which, at any year of the moon's cycle, must be added to the lunar year, to make it equal to the solar year. Since the Julian year is 365^d 6^h, and the Julian lunar year 354^d 8^h 48′ 36″, the epact for the first year of the lunar cycle will be 10^d 21^h 11′ 22″, or nearly 11 days. The epact for two years will be 22 days, and for three years 33 days, or, deducting 30, it will be 3 days. Hence we shall have the following Table, containing the epacts as established by the Council of Nice, A. D. 325.

Golden Number.	Julian Epacts.	Golden Number.	Julian Epacts.	Golden Number.	Julian Epacts.
1	XI.	8	XXVIII.	15	XV.
2	XXII.	9	IX.	16	XXVI.
3	III.	10	XX.	17	VII.
4	XIV.	11	I.	18	XVIII.
5	XXV.	12	XII.	19	XXIX.
6	VI.	13	XXIII.		
7	XVII.	14	IV.		

But as the difference between the Julian and Gregorian years is equal to 11 days, the excess of the solar above the lunar year, the Gregorian epact for any year will be the same as the Julian epact for the preceding year; and hence we shall have the following Table:

Golden Number.	Gregorian Epacts.	Golden Number.	Gregorian Epacts.	Golden Number.	Gregorian Epacts.
1	XXX.	8	XVII.	15	IV.
2	XI.	9	XXVIII.	16	XV.
3	XXII.	10	XIX.	17	XXVI.
4	III.	11	XX.	18	VII.
5	XIV.	12	I.	19	XVIII.
6	XXV.	13	XII.		
7	VI.	14	XXIII.		

The following Table contains the Gregorian epact for years when the golden number is 1; and, therefore, to find the epact for any intermediate year, we have only to add 11 for every successive year, and subtract 30 as often as is necessary:

Gregorian Years.	Epact.	Gregorian Years.	Epact.
From 1600 to 1700	1	From 3100 to 3400	24
1700 1900	30	3400 3500	23
1900 2200	29	3500 3600	22
2200 2300	28	3600 3700	23
2300 2400	27	3700 3800	22
2400 2500	28	3800 4100	21
2500 2600	27	4100 4200	20
2600 2900	26	4200 4500	19
2900 3100	25	4500 4700	18

Universal rule for finding the Epact.

' The following is an universal rule for finding the Gregorian epoch: Divide the number of centuries in any year by 4, multiply the remainder by 17, and to this product add 43 times the quotient and the number 86, and divide this sum by 25. The quotient thus found being subtracted from the golden number, multiplied by 11, will leave a remainder, which, after the thirties are taken from it, will be the epact required.

Gauss' New Method of finding Easter.

Gauss' infallible method of finding Easter.

The following very curious and infallible method of finding the time of Easter, without any reference to the lunar motions, was discovered by the celebrated German mathematician M. Gauss, and is suited either to the Gregorian or the Julian calendar.

The values of A and B are constant in the Julian calendar.	Value of A.	Value of B.
	15	6
In the Gregorian calendar.	Values of A.	Values of B.
From 1582 to 1699	22	3
1700 . . . 1799	23	3
1800 . . . 1899	23	4
1900 . . . 1999	24	5
2000 . . . 2099	24	5
2100 . . . 2199	24	6
2200 . . . 2299	25	0
2300 . . . 2399	26	1
2400 . . . 2499	25	1

By the aid of the preceding Table, and the following rules, the time of Easter may be thus found. Having taken out the values of A and B from the Table, Chronology, Mathematical.

Divide the given year by . . . . . 19 and call the rem. a
. . . . the given year by . . . . . 4 . . . . b
. . . . the given year by . . . . . 7 c
. . . . the number $(19a+\text{A})$ . . 30 . . . . d
. . . . the number$(2b+4c+6d+\text{B})$ 7 . . . . e

Then the day of Easter will be $22+d+e$ of March.
or $d+e-9$ of April.

This rule is general for the Julian calendar, and has only two exceptions in the Gregorian calendar.

I. If the day of Easter, found by the rule, is the 26th of April, always make it the 19th of April.

II. If the day of Easter, found by the rule, is the 25th of April, always make it the 18th of April.

Example.—Let it be required to find the day of Easter, according to the Gregorian calendar, for 1813. It appears from the Table, that in this year $\text{A}=23$, and $\text{B}=4$, then we have

1813 divided by 19 leaves a remainder $=8=a$
1813 . . . . . . 4 . . . . $=1=b$
1813 . . . . . . 7 . . . . $=0=c$
$(19a+\text{A})=175$. 30 . . . . $=25=d$
$(2b+4c+6d+\text{B})=156$ 7 . . . . $=2=e$

Hence $22+d+e=49$th March, which is impossible. But $d+-9=18$th April, the day of Easter required

Table *of the Reciprocal Values of the principal Periods which are employed in Chronology.*

Seconds.												
60	Minutes.											
3,600	60	Hours.										
86,400	1,440	24	Days.									
604,800	10,080	168	7	Weeks.								
2,419,200	40,320	672	28	4	Months of 28 days.							
2,505,600	41.760	696	29	$4\frac{1}{7}$		Of 29 days.						
2,592,000	40,200	720	30	$4\frac{2}{7}$		Of 30 days.						
2,678,400	44.640	744	31	$4\frac{3}{7}$		Of 31 days.						
31,536,000	525,600	8,760	365	$52\frac{1}{7}$	12	Common years.						
31,622.400	527.040	8,784	366	$52\frac{2}{7}$	12	Leap years.						
126,230,400	2,103,840	35,064	1,461	$208\frac{5}{7}$	48	4	Olympiads.					
157,760,400	2,629,440	43,824	1,826	$270\frac{6}{7}$	60	5	$1\frac{1}{4}$	Lustrum.				
220,838,400	3,680,640	61,344	2,556	$365\frac{1}{7}$	84	7	$1\frac{3}{4}$	$1\frac{2}{5}$	Sabbatical Year.			
1,545,868,800	25,764,480	429,428	17,892	2,556	588	49	$12\frac{1}{4}$	$9\frac{4}{5}$	7	Jubilee Year.		
3,155,750,000	52,596,000	876,600	36.525	$5,217\frac{6}{7}$	1,200	100	25	20	$14\frac{2}{7}$	$24\frac{2}{49}$	Centuries.	
250,029,648,000	4,197,160,800	69,952,680	2.914,695	416,385	95,760	7.980	1,995	1,596	1.140	$162\frac{6}{7}$	$79\frac{4}{5}$	Julian Period.

CHAP. II.

Historical Chronology.

Historical Chronology.

Historical Chronology is that branch of the science which treats of the æras and epochs fixed upon by different nations for determining the order of dates and of facts in their annals; or in a more extensive sense, it treats of all those historical documents, which are used for the purpose of establishing the existence of events, and the order in which they happened, such as Eclipses, Public Registers, Medals, Columns, Obelisks, Pyramids, Marbles, and Inscriptions. As many of these subjects, however, are treated under more appropriate heads than that of Chronology, we shall confine ourselves at present to the subject of Æras, Epochs, and Eclipses, as belonging more strictly to the present subject.

Table shewing the Principal Æras adopted by different Nations for determining the order of Dates.

Names of the Æras.	Years of the Vulgar or Christian Æra.	Abridged method of writing them.	Remarks.
Creation of the world.	4004 B. C. 4700 5872	A. M. Annus Mundi.	According to the Hebrew text. According to the Samaritan text. According to the Septuagint. This æra is adopted by the Greek church, and a great number of writers.
Olympiads.	776		Used by the Greeks for 1081 years, till A. D. 312, when Constantine substituted in its room the Æra of Indiction. The Greeks formerly marked their years by their Archons.
Foundation of Rome.	753	A. U. C. Anno Urbis Conditæ. P. R. C. Post Romam Conditam,	Used by the Romans till A. D. 250. The Romans formerly marked their years by their Consuls. Varro places this æra in B. C. 754, but the authority of the Capitoline Marbles is preferred.
Vulgar, or Christian æra.	0 A. D.	A. D. Anno Domini. B. C. Before Christ. A. C. After Christ.	Adopted by the greater number of writers.
Hegira.	622		Before the Hegira, the Arabians reckoned their years from the last war in which they were engaged. The word Hegira signifies *fled*, because during the night between the 15th and 16th of July, Mahomet fled from the persecution of his enemies from Mecca to Medina.
New French Æra.	1792		Adopted by the French at the foundation of their republic.
Æra of Callisthenes.	2234 B. C.	Minor Æras.	Adopted by some historians.
Æra of Nabonassar.	747		Used by Ptolemy, and Censorinus the chronologist. It received its name from having begun in the reign of Nabonassar.
Æra of the Seleucidæ.	312		This æra, which was followed by the Syrians and by the Jews established in Syria, derived its name from Seleucus Nicanor, because it began upon the day on which that prince entered Babylon.
Æra of Spain.	38		This æra was adopted by the Spanish writers, till 1415, when it was abolished by Peter of Arragon.
Æra of Actium.	30		Adopted in Egypt after the battle of Actium, and found upon several medals.
Æra of Dioclesian. Æra of the Martyrs. Æra of the Abyssinians.	284 A. D.		This æra was adopted by those who had followed the æra of Actium. It received the first name from the minions of Dioclesian, the second from the Christians who were persecuted under his reign, and the third because it was used by the Christians in Abyssinia.
Æra of Yezdejerd.	632		Adopted by the Persians of the middle ages, and named from Yezdejerd, the last king of the second empire of the Persians.
Æra of Geladdin.	1079		This æra succeeded the preceding æra in Persia, and received its name from the Sultan Gelaleddin, who reformed the Persian calendar in 1079, and made it nearly equal to the Gregorian calendar.

The following Table will shew the leading Epochs which are employed by the great Majority of Historians for determining the order of Facts.

Names of the Epochs.	Epochs.	Duration of the Epochs.	Observations.
The creation of the world	4004	1656	According to the Hebrew text.
The universal deluge	2348	427	
The calling of Abraham	1921	430	
The migration of the Israelites from Egypt	1491	479	Sacred History.
The temple of Jerusalem founded by Solomon	1012	476	
The first year of the reign of Cyrus over the greater part of Asia till the Christian æra	536	536	
The creation of the world	4004	2240	
The deluge of Ogyges	1764	507	
Expedition of the Argonauts	1263	79	
Burning of Troy	1184	408	
Æra of the Olympiads	776	240	Ancient History.
First year of the reign of Cyrus	536	224	
Æra of the Seleucidæ	312	312	
Christian æra	0	312	Muratori and the authors of the Universal History begin Modern History from this epoch.
The reign of Contantine at the æra of Indiction	312	94	
The invasion of the Roman empire by the Barbarians	406	76	
The foundation of the French monarchy	482		Millot begins *Modern History* from this epoch.
The restoration of the Western Empire	800	162	
Otho the Great obtains the empire	962	111	
The Pontificate of Gregory VIII.	1073	125	The first ten epochs of Modern History form what is called the History of the Middle Age.
The Pontificate of Innocent III.	1198	172	
The death of St Louis	1270	108	
The great schism of the West	1378	75	Modern History.
The taking of Constantinople by Mahomet II.	1453	66	
Charles V. obtains the empire	1519	44	
The Council of Trent ends	1563	40	
The Union of the Crowns of Scotland and England .	1603	85	
Revolution in England	1688	60	
Treaty of Aix-la-Chapelle	1748	41	
French Revolution	1789	13	
Treaty of Amiens	1802		

The following Table contains the principal Eclipses noticed by Historians, as having been either preceded, accompanied, or followed by some great event.

Luminary Eclipsed.	Times when they happened.	Remarkable Events by which these Eclipses were accompanied.
	Year.	
SUN.	776, 16th Oct. B. C.	Two months after the celebration of the Olympic games, which served for the date of the æra of the Olympiads.
SUN.	772, 24th June.	It preceded the year of the birth of Romulus.
SUN.	753, 5th July.	According to an old calendar, this eclipse happened on the 21st of April, the very day on which the foundations of Rome were laid.
MOON.	721, 19th March.	This eclipse was total. The Assyrian empire ended, and the Babylonian empire began.
SUN.	715, 24th May.	Romulus died in the same year.
SUN.	585, 28th May.	This eclipse was predicted by Thales. Cyaxares, king of Media, and Heliates III. king of Lydia, were so much terrified at this eclipse, that in the very heat of an engagement, they threw down their arms, and made peace.
MOON.	523, 16th July.	This eclipse, which was observed at Babylon, preceded the death of Cambyses, king of Persia.
MOON.	502, 19th Nov.	This eclipse was followed by the slaughter of the Sabines, and the death of Valerius Publicola.
SUN.	481, 19th April.	This eclipse happened at the very instant when Xerxes set out from Sardis on his expedition against Greece.
SUN.	464, 30th April.	This eclipse was followed by the assassination of Xerxes by Artabanes.

Continuation of the preceding Table.

Luminary Eclipsed.	Times when they happened.	Remarkable Events by which these Eclipses were accompanied.
	Year.	
MOON.	431, 25th April.	This eclipse was followed by a great famine, and by the Peloponnesian war.
SUN.	431, 30th Aug.	This eclipse, which was total, was accompanied with a comet, and a plague at Athens.
MOON.	413, 27th Aug.	Nicias, the Athenian general, was defeated before Syracuse.
SUN.	394, 14th Aug.	Conon, the Athenian general in the service of Persia, gains a naval victory over the Lacedemonians at Cnidos.
MOON.	331, 21st Sept.	This eclipse happened 11 days before the battle of Arbela, in which Darius was routed by Alexander.
SUN.	310, 15th Aug.	Agathocles carried the war into Africa.
SUN.	190, 14th March.	Scipio Asiaticus sets out for Asia.
MOON.	168, 28th June,	This eclipse happened in the same night in which Paulus Emilius conquered Perseus, king of Macedon.
SUN.	50, 7th Mar. A.D.	This eclipse happened when Julius Cæsar passed the Rubicon.
SUN.	31, 27th Sept.	This eclipse happened 14 days before the battle of Actium.
SUN.	14, 20th Aug.	This eclipse happened the day after the death of Augustus.
SUN.	59, 30th April.	Agrippina assassinated by order of her son Nero.
SUN.	237, 12th April.	This total eclipse was followed by a sixth persecution of the Christians.
SUN.	306, 27th July.	The stars were seen during this eclipse, and the emperor Constantius died on the 25th July.
SUN.	840, 4th May.	Louis le Debonnaire died six weeks after this eclipse.
SUN.	1009, 29th June.	Jerusalem taken by the Saracens.
SUN.	1133, 2d August.	The stars were visible during this eclipse, which was accompanied by a schism in the church, occasioned by there being three popes at once.

CHAP. III.

Comparative Chronology.

COMPARATIVE Chronology is that branch of the sciences which treats of the comparison of different æras, and is of the greatest importance in facilitating the study of history. Our limits will not permit us to enter so fully into this subject as we could have wished; but by treating it in a tabular form, we shall be able to condense into one view the most important and useful information.

The following Table will point out the relation between the principal æras which are used in history; omitting the minor æras in p. 413, which are very seldom employed by historians:

The creation of the world corresponds to	The year 4004 before Christ. The year 710 of the Julian Period. The year 3251 before the foundation of Rome. The year 5996 before the French Æra.
The 1st year of the Olympiads corresponds to	The year 776 before Christ. The year 3228 of the Creation of the World. The year 23 before the foundation of Rome. The year 3938 of the Julian Period. The year 2568 before the French Æra.
The foundation of Rome corresponds to	The year 753 before Christ. The year 3251 of the Creation of the World. The year 4 of the 6th Olympiad. The year 3961 of the Julian Period. The year 2545 before the French Æra.
The vulgar, or Christian æra, corresponds to	The year 4004 of the Creation of the World. The year 1 of the 195th Olympiad. The year 753 of the foundation of Rome. The year 4714 of the Julian period. The year 1792 of the French Æra.
The Hegira corresponds to	The year 622 of the Christian Æra. The year 4626 of the Creation of the World. The year 3 of the 348th Olympiad. The year 1375 of the foundation of Rome. The year 5336 of the Julian Period. The year 1206 before the French Æra.

The æra of the French Republic, corresponds to
The year 1792 of the Christian Æra.
The year 5796 of the Creation of the World.
The year 1 of the 643d Olympiad.
The year 2545 of the foundation of Rome.
The year 1206 of the Hegira.
The year 6506 of the Julian Period.

Use of the preceding table.

By means of the data in the preceding Table, we may easily convert the years of any one æra in those of another; and as the method of doing this is frequently of the greatest use, we shall illustrate it by a few examples.

Example 1. Cyrus took Babylon in the year of the world 3466; to what Olympiad does this year correspond?

Make $a =$ the given year, $e =$ the corresponding epoch in the Table, diminished by 1. Then the Olympiad will be $\frac{a-e}{4}-1$, the remainder being the year of the Olympiad. Thus, in the preceding example, the formula will become $\frac{3466-3227}{4}-1=59$ with a remainder of 3, which shews that the event happened in the 3d year of the 59th Olympiad.

Example 2. Socrates died in the 1st year of the 95th Olympiad; in what year of the world did this event happen?

Let a be the number of the Olympiad, b the year of the Olympiad, and c the corresponding epoch diminished by 1. Then the year of the world will be $\overline{a-1}\times 4+b+e$, or $4a-4+b+e$, which gives for answer 3604.

Example 3. To what year of the Christian æra does the 4th year of the 74th Olympiad correspond?

The letters denoting the same things as before, we have $\overline{a-1}\times 4+b-e$, or $4a-4+b-e$, which gives the year of Christ required, 481.

The formula in Example 2, and 3, is general for the translation of Olympiads into the years of other æras, or *vice versa*, with this difference only, that when the other æra is after the Olympiads, the quantity e is negative, and has the sign $-$; whereas when the other æra is before the Olympiads, the quantity e has the sign $+$.

It would be an endless task to multiply examples for all the other æras; but those who wish to draw up rules for themselves, will derive assistance from the following Table, which comprehends also some of the minor æras mentioned in page 413.

The death of Socrates, which happened in the 1st year of the 95th Olympiad, happened also in the	Year of the World	3604
	Year of Rome	354
	Year of the Julian Period	4314
	Year before the French Æra	2192
	Year before Christ	400
The Peace of Westphalia, which happened in the year of the world 5652, happened also in the	4th year of Olympiad	606
	Year of Rome	2401
	Year of Christ	1648
	Year of the Hegira	1058
	Year of the Julian Period	6362
	Year before the French Æra	144
The Peace of Amiens, signed in the year 1802 of Jesus Christ	Year of the world	5806
	2d Year of Olympiad	545
	Year of Rome	1555
	Year of the Hegira	1217
	Year of the Julian Period	6516
	Year of the French Æra	10
	Year of the Æra of Callisthenes	4036
	Year of the Æra of Nabonassar	2549
	Year of the Æra of the Seleucidæ	2114
	Year of the Æra of Spain	1840
	Year of the Æra of Actium	1832
	Year of the Æra of Dioclesian	1518
	Year of the Æra of Yezdejerd	1170

CHAP. IV.

Tabular Chronology.

Tabular chronology.

Tabular Chronology, is that branch of the science in which all the leading events recorded in history are arranged in a chronological order, or in the order of time in which they happened. Along with the great political events which accompany the rise and fall of empires, these tables ought to include the leading facts in the arts and sciences—the most striking natural phenomena, such as total and central eclipses, the appearance of comets, unusual conjunctions of the planets, the fall of meteoric stones, meteors, hurricanes, inundations, volcanic eruptions, &c.—and an account of the philosophers, statesmen, and warriors, who have acted a leading part in the revolutions of kingdoms and of science. By this means we obtain, at one glance, a general view of the various steps in the progress of society, and the eye of the reader becomes a useful auxiliary to his memory and judgment.

In drawing up the following Table, we have obtained great assistance from the Chronological Tables of Blair, Playfair, and Chantreaux; but we have presented the various events in the most abridged form, and have thus made room for many new and curious facts and phenomena which have never before been included in Chronological Tables.

A

CHRONOLOGICAL TABLE

FROM THE

CREATION OF THE WORLD TO THE YEAR 1813.

[In the following CHRONOLOGICAL TABLE, we have inserted a variety of interesting facts respecting the progress of the Arts and Sciences, which have never appeared in any System of Chronology. We have likewise added a number of curious Celestial Phenomena; and all the instances which have occurred, from the earliest times, of the fall of Meteoric Stones. For this interesting class of Atmospherical Phenomena, the Editor has been indebted to THOMAS ALLAN, Esq. F. R. S. E. who has kindly permitted him to make use of his Manuscript Paper on this subject, which contains the fullest and most correct account of Meteoric Stones that has yet been drawn up. In another part of our Work, we hope to have it in our power to present our readers with Mr Allan's valuable Paper.]

B. C.

4004. THE world created at the autumnal equinox, on Sunday, October 23.
5872, according to the Septuagint.
4700, according to the Samaritan text.
Adam and Eve created on Friday, Oct. 28.
4003. Cain born.
3875. Abel is murdered by Cain.
3874. Seth born.
3382. Enoch born;—translated to heaven, 3017, æt. 365.
3317. Methusalem born. He died at the age of 969.
2948. Noah born. He died at the age of 950.
2446. Shem born. He died at the age of 600.
2349. Noah entered the ark on Sunday, Nov. 30, and it began to rain on Sunday, Dec. 7.
2348. The deluge. On Wednesday, May 6, the ark rested on mount Ararat. On Friday, Dec. 18, Noah left the ark.
2247. The tower of Babel is built in the valley of Shinar by Noah's posterity;—the confusion of their languages, and their dispersion among different nations.
2234. Astronomical observations begun at Babylon, a register of which was transmitted by Callisthenes to Aristotle for 1903 years to the capture of that city by Alexander in the year 331 B. C.
2221. Nimrod founds the Chaldean monarchy.
2205. The first imperial dynasty of China called Kia begins. See *Mem. Inscript.* tom. xviii. p. 220.
2188. The kingdom of Egypt commences under Menes or Misraim, which lasted for 1663 years, to the conquest of Cambyses, in the year 525 B. C.
2089. The kingdom of Sicyon established, which lasts 1000 years.
2059. The kingdom of Assyria begins.
1996. Abraham born. He died 1821, B. C. æt. 175.
1897. Circumcision instituted. The cities of Sodom, &c. destroyed.
1896. Isaac born.
1856. The kingdom of Argos begins.
1827. The 17th dynasty of the six shepherd kings in Egypt begins, and continues 103 years.
1822. The letters invented by Memnon, the Egyptian.
1796. The reign of Ogyges begins.
1766. The second imperial dynasty of China called Chang begins.

B. C.

1764. The deluge of Ogyges, which laid waste Attica for more than 200 years.
1759. Jacob goes to Haran, and marries the two daughters of his uncle.
1728. Joseph sold into Egypt.
1718. Sparta built by Spartes. See *Rollin.*
1702. All the lands in Egypt sold to Joseph.
1689. Jacob predicts the coming of the Messiah, and dies æt. 147.
1635. Joseph foretels the egress of the Israelites from Egypt, and dies æt. 110, having been præfect of Egypt for 80 years.
1615. The Ethiopians from the Indus settle near Egypt.
1582. The chronology of the Arundelian marbles begins, when Cecrops is supposed to have come into Attica.
1575. Pharaoh orders all the children of the Israelites to be drowned.
1571. Moses born.
1570. Pyramids of Egypt built.
1556. Cecrops, with a colony of Saites from Egypt, founds Athens.
1546. About this period Scamander comes from Crete and founds Troy.
1531. Moses visits the Israelites; flies into Midian, and continues there 40 years.
1503. The deluge of Deucalion in Thessaly, placed by the Arundelian marbles in 1521.
1500. First eruption of Ætna. See *Collection. Academique,* tom. vi. p. 489.
1497. The council of Amphictyons established.
1493. The Phœnician letters carried into Greece by Cadmus, who built the citadel of Thebes.
1491. God appears in a burning bush to Moses, and sends him into Egypt. Moses opened a passage for the Israelites through the Red Sea.
1485. The first ship that appeared in Greece, brought from Egypt by Danaus. The pump supposed to have been invented.
1480. Troy supposed to have been built by Dardanus.
1453. The first Olympic games celebrated at Elis.
1451. Moses dies, æt. 110.
1445. Joshua partitions the land of Canaan.
1426. Joshua dies at Timnath-Serah, æt. 110.
1406. Minos gives laws to Crete. Iron found from

B. C.

the burning of the woods of mount Ida in Crete.

1390. Benjamin almost destroyed by the other 11 tribes.

1383. Ceres taught the Athenians the arts of agriculture, &c.

1356. The Eleusinian mysteries introduced at Athens.

1344. The kingdom of Mycenæ begins about this time, when the kingdom of Argos was divided.

1326. The Isthmian games instituted by Sysiphus.

1325. The great Egyptian canicular year began on Saturday, July 20, and consisted of 1460 years.

1307. The Olympic games instituted by Pelops.

1300. The Lupercalia instituted.

1285. Deborah defeats the Canaanites under Sisera.

1284. The Siculi pass out of Italy into Sicily; according to others, the first colony arrived in 1294, and a second in 1264.

1263. The expedition of the Argonauts;—according to others, in 1225. About this time the Pythian games were instituted by Adrastus.

1252. The city of Tyre built.

1245. Gideon routs the Midianites.

1243. Arcadians conducted by Evander into Italy.

1234. Theseus establishes a democracy in Attica, and renews the Isthmian games; others say in 1231.

1233. Carthage built by a colony of Tyrians.

1225. The Theban war of the 7 heroes against Eteocles.

1222. The celebration of the Olympic games by Hercules.

1213. Helen carried off by Theseus.

1198. Helen carried off by Paris; others say in 1204.

1194. The Trojan war begins, and continues 10 years.

1188. Jephtha, the 7th judge of Israel for 6 years, his rash vow with respect to his daughter.

1184. Troy burned by the Greeks, on the 11th of June, 408 years before the first olympiad. Æneas sails early in autumn for Thrace.

1182. The kingdom of the Latins begins under Æneas.

1179. The maritime power of the Mediterranean acquired by the Lydians.

1176. Salamis in Cyprus built by Teucer.

1157. Eli the high priest, 11th judge of Isael for forty years.

1152. The city of Alba-Longa built by Ascanius.

1141. The Amazons burned the temple of Ephesus.

1136. Samson slays 3000 Philistines.

1124. The migration of the Æolian colonies. Thebes built by the Bœotians.

1122. The 3d dynasty of China, called Tcheou, begins.

1115. The mariner's compass said to be known in China.

1104. The Heraclidæ return into Peloponnesus; and divide it. The kingdom of Lacedæmon begins. That of Mycene ends.

1088. The kingdom of Sicyon ends; others say in 1130.

1070. Athens governed by archons.

1058. The maritime power of the Mediterranean acquired by the Pelasgians.

1055. Saul kills himself on mount Gilboa.

1048. Jerusalem taken by David; and made the seat of his kingdom.

1044. The Ionian colonies migrate from Greece.

1023. Absalom rebels, and is killed by Joab.

1012. Solomon begins to build the temple.

000. The maritime power of the Mediterranean acquired by the Thracians, who hold it 19 years.

996. Solomon's fleet prepared in the Red Sea, and sent to Ophir.

992. Solomon's palace finished.

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986. Samos, in the island of the same name, and Utica, built about this time.

975. The kingdoms of Judah and Israel divided.

974 or 971. Sesac, king of Egypt, takes Jerusalem, and plunders the temple.

926. Lycurgus, the Spartan lawgiver, born.

916. The maritime power of the Mediterranean acquired by the Rhodians, who maintain it 23 years.

907. Homer wrote his poems and flourished.

900. The kingdom of Assyria ends.

896. Elijah the prophet taken up into Heaven.

893. The maritime power of the Mediterranean acquired by the Phrygians.

884. Lycurgus, after travelling 10 years, establishes his laws in Lacedæmon. The Olympic games restored at Elis.

872. The art of sculpture in marble said to be invented.

869. Scales and measures invented by Phidon, king of Argos, who also coined silver at Ægina. The city of Carthage built by Dido; others say it was enlarged by her in 864.

868. The Cyprians acquire the maritime power of the Mediterranean.

839. The kingdom of Judah desolated by the army of Hazael, king of Syria.

826. The maritime power of the Mediterranean acquired by the Phœnicians.

820. Nineveh taken by Arbaces, and Belesis; Sardanapalus burns himself to death.

814. Kingdom of Macedon begins, and continues 646 years, till the battle of Pydna.

801. Capua, in Campania, built.

797. Kingdom of Lydia begins.

790. Amos the prophet flourished. He prophesied in 787.

787. The Egyptians acquire the maritime power of the Mediterranean.

786. The Corinthians invented ships called Triremes.

779. The race of kings terminated at Corinth, and was succeeded by magistrates, called Prytanes elected annually.

770. Phul invades the kingdom of Israel, and is bribed to depart with 1000 talents.

760. Theopompus establishes the Ephori at Lacedæmon.

754. The decennial archons begin at Athens. The Milesians acquire the maritime power of the Mediterranean.

753. Rome built, according to Varro, April the 20th. or the 12th of the kalends of May.

750. The rape of the Sabines.

747. Union of the Romans and Sabines. The æra of Nabonassar begins.

743. The first war between the Messenians and Lacedæmonians begins, and continues 19 years.

734. The Carians acquire the command of the Mediterranean.

732. Syracuse built by a colony of Corinthians under Archias; others say in 758.

724. The first Messenian war ended by the capture of Ithome, which subjected them to the Lacedæmonians.

722. The Chinese empire divided into principalities. Confucius's history of China begins.

721. Samaria taken, after three years siege. The first eclipse of the moon on record, according to Ptolemy, March 19th, 3 hours 20′ before midnight.

720. The 2d and 3d eclipse of the moon on record; the

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2d on March 5th, 50′ before midnight; and the 3d on September 1st, 4 hours 20′ before midnight, according to the meridian of Alexandria.

717. Unsuccessful siege of Tyre for about five years by Salmanaser king of Assyria.

713. Gela in Sicily founded. Senacherib's army destroyed in one night by an angel, to the amount of 185,000 men.

709. The Salii, an order of priests, instituted by Numa.

708. Ecbatana built by Dejoces.

707. Tarentum built by the Parthenians, on being expelled from Sparta.

703. Corcyra built by the Corinthians.

696. Isaiah sawn asunder by order of Manasses.

690. Holofernes besieged Bethulia, and killed by Judith.

686. Archilochus invented the Iambic verse.

685. The Messenian war continues from 685 to 671.

684. Athens governed by annual archons. Tyrtæus the poet flourished.

683. The Lacedæmonians defeated by Aristomenes.

680. Assaradinus king of Assyria, takes Babylon. The chariot race instituted at the Olympic games.

678. Dejoces extends Media to the river Halys.

677. Manasseh king of Judah carried prisoner to Babylon.

676. The Lesbians acquire the command of the Mediterranean, and retain it about 69 years.

675. The annual festivals of Carnia instituted at Sparta. Terpander the poet the first victor.

673. Terpander added three strings to the lyre. Thaletas of Gortynius, in Crete, the musician.

671. The second Messenian war finished, and the Messenians driven from the Peloponnesus.

670. Alcman of Sardis, the lyric poet.

667. The combat between the Horatii and the Curiatii.

665. The city of Alba destroyed. The Messenians settled in Italy. War between the Romans and the Fidenates.

659. Cypselus usurps the government of Corinth, and retains it for 30 years.

658. Byzantium built by a colony of Argives. Others place the building of it in 670.

652. A shower of meteoric stones fell at Mount Alba.

651. A five years' war between the Romans and Sabines begins. Cyrene in Africa founded.

648. The Thoth of the year of Nabonassar was on February 1st, having shifted 25 days in 100 years.

641. Amon, king of Judah, slain by his servants.

636. The Tartars defeat the Chinese with great slaughter.

631. War between the Romans, and the Fidenates and Sabines, which continues for fifty years.

630. Cyrene built by Battus, who begins that kingdom.

629. The government of Corinth usurped by Periander.

627. Jeremiah the prophet flourished.

626. Zephaniah the prophet flourished.

625. The Pentateuch found by Hilkiah.

624. The Scythians invade Media, Lydia, &c. Draco the lawgiver, archon at Athens.

623. Draco establishes his laws at Athens.

621. War between the Lydians and Milesians, which continues 11 years. The fourth eclipse on record, which was of the moon, on Saturday April 22d, three hours after midnight, according to the meridian of Alexandria.

610. Necho begins the canal between the Nile and the Red Sea.

B. C.

608. Josiah, king of Judah, killed at Megiddo by Pharaoh Necho, king of Egypt.

607. Alcæus the poet flourished.

606. Nineveh destroyed by the armies of Cyaxares and Nabopolassar.

605 or 606. The first captivity of the Jews.

604. The Phœnicians about this time sail from the Red Sea round Africa, and return by the Mediterranean.

600. Sappho the Lyric poetess flourished.

596. The Scythians expelled from upper Asia, by Cyaxares. Epimenides of Crete, the first builder of temples in Greece.

594. Solon, archon and lawgiver of Athens. Thales of Miletus.

593. Ezekiel the prophet flourished.

592. Anacharsis the Scythian flourished.

591. The Pythian games first celebrated at Delphi.

590. The Lydian war begins, and continues six years.

587. The city of Jerusalem taken by Nebuchadnezzar.

586. The temple of Jerusalem burned.

585. A battle upon the river Halys between Cyaxares and Halyattes, interrupted by an eclipse of the moon, May the 28th, predicted by Thales. Æsop the mythologist flourished.

582. The Isthmian games restored.

580. Money first coined in Rome.

579. The Megarensian war. Stesichorus the poet flourished.

572. Tyre taken by Nebuchadnezzar.

571. Apries, king of Egypt, dethroned by Nebuchadnezzar.

569. Daniel interpreted Nebuchadnezzar's dreams according to Josephus.

568. The Nemæan games restored. Anaximander of Miletus, and Phalaris tyrant of Agrigentum flourished.

566. The first census at Rome—84,700 citizens.

562. The first comedy at Athens, acted upon a scaffold by Susarion and Dolon.

560. Pisistratus usurped the tyranny of Athens, which he recovered after expulsion in 557, and from which he was again expelled in 556.

559. Daniel delivered his predictions. Cyrus ascended the Persian throne.

556. Anaximenes of Miletus flourished.

550. Cyrus king both of Media and Persia. The kingdom of Lydia ended.

549. Theognis the poet flourished. The Pisistratidæ burn the temple of Apollo at Delphos.

548. Crœsus crossing the Halys by an artificial bridge contrived by Thales, is routed by Cyrus.

539. The Phocæans settle in Gaul, and build Marseilles. Pythagoras flourished.

538. Cyrus takes Babylon, and terminates the kingdom of Babylon.

537. Simonides of Cea, the poet, flourished.

536. Cyrus issues an edict for the return of the Jews and the rebuilding of the temple. Thespis the inventor of tragedy lived.

535. The first tragedy acted about this time at Athens, by Thespis in a waggon. According to the Arundelian marbles in 536.

532. Anacreon the poet flourished.

530. Cyrus marches against the Scythians.

527. Learning encouraged at Athens. A public library first founded. War between the Romans and Sabines.

B. C.

526. Cambyses conquered Egypt. A comet appeared in China, near Antares, or *a Scorpionis*, and extended to the milky way.
523. The 5th lunar eclipse observed at Babylon, on Wednesday, July 16th, one hour before midnight, and more than 6 digits eclipsed on the northern disk.
520. Confucius lived. The 2d edict to rebuild Jerusalem.
519. A great earthquake in China.
515. The temple of Jerusalem finished March 10. The passover celebrated, April 18.
512. Babylon revolts from Darius, but is recovered two years after.
510. The tyranny of the Pisistratidæ abolished at Athens.
509. The consular government begins at Rome, on the expulsion of Tarquin and his family, Feb. 26.
508. First alliance between Rome and Carthage.
507. The second census in Rome—130,000 citizens.
506. Heraclitus the philosopher lived. Megabysus subdues Thrace and Macedonia. War between the Romans and Sabines.
505. Parmenides of Elea, the philosopher, lived.
504. Sardis burned by the Athenians, which occasioned the invasion of Greece by the Persians.
502. The sixth lunar eclipse observed at Babylon on Monday, Nov. 19, 24′ before midnight—3 digits eclipsed on the south part of the disk.
498. The Ionians, after a revolt, subdued by the Persians, and Miletus taken.
497. The Saturnalia instituted at Rome—150,700 citizens.
495. Tarquin the proud dies at Cuma.
494. War between the Romans and Sabines.
493. Tribunes created at Rome. The Athenians build the port of Piræus.
491. The kingdom of Syracuse usurped by Gelo. Coriolanus banished from Rome. The seventh lunar eclipse observed at Babylon, on Wednesday, April 25—2 digits of the moon's south limb eclipsed.
490. The Persians defeated by Miltiades, at Marathon.
488. Coriolanus withdraws the Volsci from Rome.
487. Egypt rebels, and revolts from the Persians.
486. Æschylus first gains the prize of tragedy.
485. Cassius punished for usurping the sovereignty. The Volsci and Æqui subdued.
484. Aristides banished from Athens. Xerxes recovers Egypt.
483. Quæstors first created at Rome. An eruption of mount Ætna.
481. Xerxes begins his expedition against Greece.
480. The affair of Thermopylæ finished, Aug. 7th. The Persians defeated at Salamis in a sea-fight, Oct. 20th. Pindar the lyric poet flourished, ob. 435, æt. 86. A comet appeared with a curved tail, according to Lubiniezki.
479. The Persians defeated at Platæa, Sept. 22; on which day happened the battle of Mycale. War between the Romans and Hetrurians. Charon of Lampsacus, the historian, lived.
477. The 300 Romans, of the name of Fabius, killed by the Veientes near Cremona, July 17.
476. Valerius triumphed over the Veientes and Sabines, 103,000 citizens in Rome. A great eruption of mount Ætna.
471. Themistocles retires to Xerxes in Asia.
470. Cimon defeats the Persian fleet at Cyprus, and the army near the river Eurymedon in Pamphylia. An eruption of Mount Ætna. Anaxagoras of Clazomene, the philosopher, ob. 420, æt. 72.
469. An earthquake at Sparta. The Tuscans found Capua. A comet appeared, according to Riccioli.
467. A meteoric stone, the size of a cart, fell at Ægospotamos, in Thrace. Pliny assures us, that this stone was preserved in his time; and that another fell at Abydos, and a third at Protidea.
466. The Syracusans recover their liberty. A comet appeared for 75 days, according to Lubiniezki.
463. Egypt revolts from the Persians, but obtains the aid of the Athenians. A great pestilence in Rome. Sophocles, the tragic poet, ob. 406, æt. 91.
462. The Persians defeated by the Athenians in a naval engagement, in Egypt.
461. Earthquakes and numerous prodigies in Rome.
460. The third Messenian war with the Lacedemonians begins, and continues ten years.
459. The Athenians begin to exercise tyranny over the other Grecian states.
458. Cincinnatus appointed dictator. War between the Corinthians and Megareans.
456. The Athenians, deserted by the Egyptians, retire out of Egypt by capitulation with the Persians. The *ludi seculares* celebrated for the first time at Rome.
454. The Romans send deputies to Athens for a copy of Solon's laws. An eruption of Ætna.
453. Aristarchus, the tragic poet, flourished.
451. The decemvirs created at Rome, and the laws of the twelve tables compiled and ratified.
450. Cimon triumphs over the Persians by sea and land. Zaleucus, the lawgiver of Locri.
449. The decemvirs banished. The Persians make a shameful peace with the Greeks.
448. The first sacred war about the temple of Delphi. Hellanius, the historian, ob. 411, æt. 85.
447. The Bœotians defeat the Athenians at Chæronea.
446. A thirty years' truce between the Athenians and Lacedæmonians. Thucydides banished by the ostracism.
445. Herodotus reads his history in the council at Athens at the age of 39 years. Military tribunes created at Rome.
444. The Athenians send a colony to Thurium in Italy, of which number were Herodotus, Thucydides, and Lysias. Empedocles of Agrigentum, the philosopher, flourished.
443. Censors first created at Rome.
442. Universal peace. Euripides gained the prize of tragedy at Athens, at the age of 43 years, ob. 407, æt. 78.
441. The battering ram, the testudo, and other military instruments, invented by Artemones of Clazomene. Pericles subdues Samos. A great famine at Rome.
440. Comedies prohibited at Athens. Phidias the sculptor flourished, ob. 432.
439. War between Corinth and Corcyra.
437. Cratinus, the comic poet, ob. 431.
436. Malachi, the last of the prophets, delivered his predictions.
435. The Romans take Fidenæ. The Corinthians defeated by the Corcyræans. Eupolis the comic poet lived, ob. post 415.
434. Aristophanes, the comic poet, ob. post. 389.
433. Temple of Apollo consecrated. A comet appeared in China.

B. C.

432. Metonic cycle begins. Meton ob. post 415.

431. Peloponnesian war begins May 7, and lasts near 27 years. Euctemon the astronomer flourished. A comet appeared, which continued visible for 60 days. See Lubiniezki and Hevelius, the last of whom places it in 430.

430. The history of the Old Testament finishes about this time. A plague at Athens for five years.

429. Socrates the philosopher flourished, ob. 400, æt. 70.

428. Democritus of Abdera, ob. 361, æt. 109.

427. Gorgias of Leontium, the orator, ob. 400. æt. 108.

426. The plague breaks out at Athens a second time. Thucydides the historian flourished, ob. about 391, æt. about 80. An eruption of Mount Ætna.

425. Hippocrates of Cos, the physician, ob. 361. æt. 99.

424. Aristophanes' first comedy of the Clouds acted against Socrates.

423. A truce between the Lacedemonians and Athenians.

421. A peace of 50 years between the Lacedæmonians and Athenians.

420. Alcibiades, the Athenian general, ob. 404, æt. 46.

419. Protagoras of Abdera, the sophist, flourished.

418. The Lacedæmonians gain a signal victory over the Argives and Mantineans.

416. The Agrarian law proposed at Rome.

415. Alcibiades accused at Athens. Parrhasius, of Ephesus, the painter.

414. Egypt revolts from the Persians. The second part of the Peloponnesian war begins. A comet appeared.

413. An eclipse of the moon, Aug. 27, by which Nicias was so terrified that he lost the Athenian army in Sicily.

412. The Athenians are deserted by their allies. Lysias the orator, ob. 378, æt. 81. Four hundred persons elected to the government of Athens. A comet appeared in winter in the North.

411. A comet appeared. See *Hevelius.*

410. The Athenians defeat the Lacedæmonians at Cyzicum. The history of Thucydides ends, and that of Xenophon begins. The Carthaginians attack Sicily. A comet appeared. See *Riccioli.*

408. The Romans defeat the Volsci. The Athenians seize the Hellespont.

407. The Carthaginians renew their attack upon Sicily.

406. Agathon the comic poet flourished.

405. The Athenian fleet of 180 ships defeated at Ægospotamos by Lysander. Syracuse usurped by Dionysius. Cebes the philosopher

404. Lysander takes Athens, and finishes the Peloponnesian war. Athens governed by 30 tyrants. Euclid of Megara, the philosopher.

403. The Roman infantry first received pay.

402. Telestes, the dithyrambic poet, flourished.

401. Cyrus killed in an expedition against Artaxerxes. The retreat of the 10,000 Greeks under Xenophon. The 30 tyrants expelled from Athens by Thrasybulus, and the democratic government established. A comet appeared. See *Lubiniezki.*

400. The Athenians put Socrates to death. Xenophon the philosopher, ob. 359, æt. about 90.

399. The feast called *Lectisternium* instituted at Rome.

398. Military catapultæ invented by Dionysius about this time. Ctesias, the physician and historian, ob. after 384. Many prodigies are seen at Rome.

397. Dionysius of Syracuse declares war against the Carthaginians. Zeuxis the painter flourished.

396. Antisthenes, called the Cynic philosopher.

395. The Athenians, Thebans, Corinthians, and Argives, unite against the Lacedæmonians.

394. A sea-fight at Cnidus, between the Persians and Lacedæmonians. The Corinthian war commences. Archytas of Tarentum, the mathematician, ob. after 360.

393. Argives take possession of Corinth.

390. The Romans defeated at the battle of Allia by the Gauls, who marched to Rome, and burned it.

389. Plato's first travels into Sicily, ob. 348, æt. 81.

388. Dionysius takes Rhegium Philoxenus the dithyrambic poet.

387. The peace of Antalcidas between the Lacedæmonians and Persians. Rome contained 152,583 effective men. Damon and Pythias, the Pythagorean philosophers and friends.

385. The Cyprian war finished.

380. Isæus of Chalcis, the Athenian orator, ob. about 360.

378. Isocrates the rhetorician, ob. 388, æt. 99.

377. The Lacedæmonians defeated in the naval battle at Naxus, Sept. 20.

376. Artaxerxes makes peace with the Greeks.

374. The unsuccessful expedition of the Persians under Artaxerxes into Egypt. Philolaus the Pythagorean philosopher.

373. A great earthquake in Peloponnesus. A comet appeared in Greece in winter, near Orion. See *Lubiniezki.*

372. Diogenes, the Cynic philosopher, ob. 324. æt. 90.

371. The Lacedæmonians defeated by the Thebans under Epaminondas at the battle of Leuctra, July 8. A comet appeared.

370. The Messenians return to Peloponnesus, after an exile of about 300 years.

368. Eudoxus brought the sphere from Egypt into Greece, ob. about 352, æt. 53.

367. The populace at Rome succeed in making one of the consuls a plebeian. The Gauls, who invaded the Roman territories, are defeated by Camillus.

365. The Romans renew the custom of fixing the chronological nail in the temple of Jupiter, on the 13th of Sept. Livy places it in 363.

363. Epaminondas killed at the battle of Mantinea. Aristippus junior, the Cyrenaic philosopher.

362. Revolt in Lesser Asia of several Persian governors against Artaxerxes.

360. Philip defeats the Athenians at Methon. Plato's second voyage into Sicily.

359. Philip gains a second battle over the Illyrians. Earthquake at Rome, by which M. Curtius is swallowed up.

357. The second sacred war begins. Dionysius junior expelled Syracuse by Dion. Aristotle observed the moon's transit over Mars, April 4.

356. A comet appeared. See *Hevelius.*

354. Dion put to death. Theopompus of Chios, the orator and historian. A comet appeared, the tail of which was successively elongated.

353. Philip defeats the Phocians in Thessaly.

352. Ephorus of Cumæ, the historian, flourished.

351. The Sidonians, besieged by the Persian army, burn their city, and put themselves to death. The monument of Mausolus erected.

350. Egypt conquered by Ochus.

B. C.

348. Philip concludes the sacred war after taking the cities of the Phocæans. Speusippus, the academic philosopher, ob. 339. A comet appeared in Greece. See *Lubinieski.*

347. Dionysius recovers Syracuse.

345. Aristotle the philosopher flourished, ob. 322. æt. 63.

343. War between the Romans and Samnites commences and continues 71 years. Timoleon restores the liberty of Syracuse; expels Dionysius, and establishes a democracy. Protogenes of Rhodes, the painter, ob. about 320. The Syracusan æra commenced. Philip makes Thrace tributary. A plague at Rome.

341. A comet appeared near the equator, in Greece. See *Riccioli.*

340. The Carthaginians defeated near Agrigentum by Timoleon, July 13.

339. Xenocrates, the academic philosopher, ob. 314. æt. 82.

338. The Athenians defeated by Philip, &c. in the battle of Chæronea, Aug. 2.

336. Philip killed by Pausanias. A comet appeared in Greece, and was seen for 70 days. Stilpo of Megara, the philosopher, ob. after 294.

335. Alexander enters Greece, destroys Thebes, but preserves the house of Pindar. Demades, the Athenian orator, ob. 322.

334. Alexander defeats the Persians on the Granicus May 22. Apelles of Cos, the painter.

333. Alexander gains a second battle at Issus, in October. Callisthenes, the philosopher, ob. 328.

332. Alexander takes Tyre, Aug. 20; obtains possession of Egypt, and builds Alexandria. Dinocrates the mathematician.

331. Darius defeated by Alexander in the battle of Arbela, Oct. 2, eleven days after a total eclipse of the moon.

330. The cycle of Calippus commences from Darius's death, July 1. Æschines the orator banished.

329. Hyperides, the Athenian orator, ob. 322.

328. Philetas of Cos, the poet and grammarian, ob. about 280. Alexander passed the mountain of Caucasus.

327. Alexander's expedition into India against Porus.

326. Lysippus the statuary flourished.

325. Menedemus of Eretria, ob. about 301, æt. 74. Demosthenes banished from Athens, recalled in 23, and died in 322, æt. 60.

324. Crates of Thebes, the Cynic philosopher, ob. after 287.

323. Alexander dies, April 21, and his empire divided. Praxiteles, the statuary, ob. after 288.

322. Antipater puts to death the Athenian orators, Demosthenes, Hyperides, and Demades. Theophrastus, the Peripatetic philosopher, ob. about 288, æt. 85.

321. The Romans defeated by the Samnites.

320. Polysperchon proclaims general liberty to all the Greek cities. Ptolemy carries 100,000 Jews captives into Egypt. Menander, the inventor of the new comedy, ob. 293, æt. 52.

319. The Romans subdue the Samnites.

318. Phocion put to death by the Athenians. Cassander [illegible] master of Athens.

317. Agathocles usurps the government of Syracuse and [illegible] Demetrius Phalereus governs Athens for 10 years; expelled from Athens in 307; ob. about 284.

B. C.

315. Cassander rebuilt Thebes, and founded Cassandria. Rhodes nearly destroyed by an inundation.

314. The cities of Peloponnesus recover their liberties. Dinarchus, the Athenian orator, banished in 307.

313. Polemon, the Academic philosopher, ob. 270.

312. Babylon taken by Seleucus. The æra of the Seleucidæ commences. Zeno of Cittium in Cyprus, the first of the Stoic philosophers, ob. 264. æt. 98.

310. The Carthaginians defeat Agathocles, July 22, who carries the war into Africa; during his passage, the sun was eclipsed, Aug. 15, 11 digits 10′. A comet appeared in China. Crantor, the Academic philosopher, ob. before 270.

308. The Samnites, Marsi, and Peligni defeated by Fabius. Philemon, the comic poet, ob. about 274.

307. The oligarchy of Athens changed into a democracy.

306. The successors of Alexander take the title of kings.

305. Megasthenes, the historian.

304. Seleucus founded Antioch, Edessa, Laodicea, &c. Pyrrho, the philosopher, ob. æt. 90.

301. Antigonus defeated at the battle of Ipsus.

300. Euclid of Alexandria, the mathematician.

298. Arcesilaus the philosopher founder of the middle Academy, ob. about 241, æt. 73.

296. Athens taken by Demetrius Poliorcetes. Epicurus, the philosopher, ob. 270, æt. 72.

294. Timocharis of Alexandria observed, March 9th, 4 hours before midnight, a conjunction of the moon with *Spica Virginis*, ob. after 272. Rome contained 270,000 effective men.

293. The first sun-dial erected at Rome upon the temple of Quirinus by Papirius Cursor. Erasistratus, the physician, ob. about 257.

292. Aristyllus of Alexandria, the astronomer.

291. Seleucus builds and peoples about 40 new cities in Asia.

290. The Samnite war ended. Fabius introduces painting into Rome. Bion Borysthenites, the philosopher, ob. 241.

288. Strato, the Peripatetic philosopher, ob. about 270.

287. The Athenians revolt from Demetrius Poliorcetes. Zenodotus of Ephesus, the first librarian of Alexandria, ob. about 245.

286. Macedon taken possession of by Lysimachus, and Pyrrhus expelled.

285. Dionysius, the astronomer of Alexandria, began his æra on Monday June 26th. He was the first who found the exact solar year to consist of $365^{d}\ 5^{h}\ 49'$—ob. 241.

284. The Septuagint translation of the Old Testament supposed to have been made. The pharos of Alexandria built. Achæan republic founded. A great earthquake in the Hellespont and Chersonesus. The Gauls defeat the Romans.

283. Sostratus of Cnidus, the architect. The college and library of Alexandria founded.

282. Timocharis observed, Nov. 9th, $3\frac{1}{2}$ hours after midnight, a second conjunction of the moon with *Spica Virginis.* Theocritus of Syracuse, the pastoral poet.

280. Pyrrhus assists the Tarentines in Italy. Aristarchus of Samos, the astronomer, flourished.

279. Dionysius Heracleotes, the philosopher. Rome contains 278,222 citizens.

278. An army of Gauls under Brennus cut to pieces near the temple of Delphi. Philo, the dialectic philosopher, ob. about 260.

B. C.

277. Aratus of Tarsus, the astronomical poet.

276. Lycophron of Chalcis, the poet.

275. The Romans defeat Pyrrhus, who retires to Epirus. Persæus, the Stoic philosopher.

272. The Romans defeat the Samnites and Tarentines. Pyrrhus killed at the siege of Argos. Lycon, the Peripatetic philosopher, ob. 226, æt. 74.

269. Silver first coined at Rome. Crates, the Academic philosopher, ob. about 250.

268. Athens taken by Antigonus Gonatas. Berosus, the Chaldæan historian.

267. Ptolemy made a canal from the Nile to the Red Sea. Hermachus of Mitylene, the Epicurean.

265. Rome contains 292,226 citizens.

264. The first Punic war. The Arundelian marbles, composed. Cleanthes, the Stoic philosopher, ob. about 240, æt. 80.

263. Homer, jun. the tragic poet.

262. The battle of Sardis. Timæus of Sicily, the historian, ob. æt. 96.

261. The Romans attend to maritime affairs. Manetho, the Egyptian historian.

260. The Carthaginians defeated at sea by the Romans. Callimachus of Cyrene, the poet, ob. about 244.

259. Zoilus the critic, called Homero-Mastix.

258. Duris of Samos, the historian.

257. Neanthes of Cyzicum, the orator and historian.

256. Regulus defeated and taken prisoner. Antigonus restores the liberty of Athens. Ctesibius, the historian, ob. æt. 104.

255. The fourth imperial dynasty of China begins. Sosibius of Lacedæmon, the critic.

254. Hieronymus of Rhodes, the Peripatetic philosopher.

252. Rome contains 297,897 effective men.

251. Aratus joins the Achæan league.

250. The Parthians revolt from the Macedonians.

249. The Romans defeated by the Carthaginians in the naval battle of Drepanum.

248. Antigonus Carystius, the historian.

247. Jesus, the son of Sirach. A census at Rome—251,212 citizens.

246. Ptolemy kills Laodice, and subdues great part of Syria. Conon of Samos, the astronomer, ob. after 223.

245. Eratosthenes of Cyrene, librarian of Alexandria, ob. 194, æt. 82.

243. The citadel of Corinth taken by Aratus. Sphærus, the Stoic philosopher and historian.

242. The Carthaginians defeated. The first Punic war ended. Apollonius of Perga, the geometer.

241. Agis, king of Sparta, is put to death, attempting to settle an Agrarian law.

240. Plays acted at Rome, being those of Livius Andronicus, the first Roman dramatist.

239. Chrysippus, the Stoic philosopher, ob. 207, æt. 73.

238. The Carthaginians terminate the Libyan war. Polystratus, the Epicurean philosopher.

237. Hamilcar, with his son Hannibal, leads the Carthaginians into Spain. Euphorion of Chalcis, the poet, ob. about 220. æt. 56.

236. The Tartars expelled from China. Archimedes of Syracuse, the mathematician, ob. 212.

235. Rome being at peace with all nations, the temple of Janus was shut the first time after Numa. Messala, the Roman painter, ob. after 226.

234. The Sardinian war begins. Nævius, the comic poet, ob. 203.

B. C.

231. The first divorce at Rome. Sardinia and Corsica conquered by the Romans.

230. Apollonius Rhodius, the poet and third librarian of Alexandria. Eratosthenes observed the obliquity of the ecliptic to be 23° 51′ 20″.

229. The Romans declare war against the Illyrians.

228. The Roman ambassadors first appear at Athens, Corinth, &c. Philochorus of Athens, the historian, ob. 222.

226. Aristo Ceus, the philosopher, ob. about 183.

225. Cleomenes kills the Ephori, and restores the Agrarian laws of Sparta. The Gauls defeated in Italy. Fabius Pictor, the first Roman historian.

224. The Romans for the first time crossed the Po. The Colossus of Rhodes overturned by an earthquake.

221. Phylarchus, the historian.

220. Rome contains 270,213 citizens. The social war in Greece begins, and lasts 3 years. Plautus of Umbria, the comic poet, ob. 184. A comet appeared in Aries, and was seen 22 days.

219. Saguntum destroyed by Hannibal. The art of surgery introduced into Rome.

218. The second Punic war begins with Hannibal's passing the Alps, and continues 17 years.

217. The Romans defeated at Thrasymene.

216. The Romans totally defeated at Cannæ.

215. Evander, the philosopher of the second Academy.

213. All the records in China destroyed by Shee-hoangtee. Erroneously placed by many in 246.

212. Syracuse taken by Marcellus after a siege of 3 years.

210. Hermippus of Smyrna, the Peripatetic philosopher.

207. Claudius Nero defeats and kills Asdrubal. Zeno of Tarsus, the Stoic philosopher.

205. Ennius of Calabria, the poet, brought to Rome by Cato the quæstor. Sotion of Alexandria, the grammarian.

204. Scipio besieged Utica. A meteor in the form of a star appeared. It extended from the east to the west points of the horizon. See *Lubiniezki*.

203. Scipio in one day took the two camps of Asdrubal and Syphax. Hannibal recalled.

202. The fifth imperial dynasty of China begins. Hannibal defeated by Scipio at Zama, Oct. 19. A shower of meteoric stones fell in Italy.

201. Peace obtained by the Carthaginians, and the end of the 2d Punic war.

200. The first Macedonian war begins, and continues near 4 years. Aristophanes of Byzantium, the grammarian, ob. æt. 80. A comet appeared in Cancer.

198. Sidon taken by Antiochus after the battle of Panius. Asclepiades Myrlianus, the grammarian.

197. The Romans send two prætors into Spain. Licinius Tegula, the comic poet.

196. Caius Lælius, the Roman orator. A comet appeared. See *Hevelius* and *Cæsius*.

195. Aristonymus, the 4th librarian of Alexandria, ob. æt. 77.

194. A comet appeared. A shower of meteoric stones fell in Italy. Sparta and Hither Spain subdued by the Romans.

193. Hyginus of Pergamus, philosopher of the second Academy.

192. The war of Antiochus the Great with the Romans begins, and continues 3 years. Rome contains 243,704 effective men.

191. Earthquakes were felt at Rome during 38 days.

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190. Scipio defeats Antiochus in the battle of Magnesia.

189. The Romans make peace with Antiochus.

188. Philopæmen compels the Lacedæmonians to renounce the laws of Lycurgus.

187. Antiochus defeated and killed in Media. Scipio Africanus banished from Rome.

185. Diogenes of Babylon, the Stoic philosopher.

183. Philopæmen defeated and killed by Dinocrates, tyrant of the Messenians. The Transalpine Gauls march into Italy. A very large comet appeared, and continued visible for 80 days. See *Lubiniezki* and *Hevelius.*

182. The stars appeared in China in the day time.

181. The plague rages at Rome.

180. Demetrius is killed by his father Philip. Statius Cæcilius, the comic poet, ob. after 166.

179. Rome contains 273,244 effective men. Some books of Numa found at Rome in a stone coffin, supposed by Livy to be forged, and burned.

177. Agarthacides of Cnidus, the historian.

176. Heraclides, called Lembus, the historian.

175. A great earthquake in China. Pestilence at Rome.

174. A comet appeared. See *Hevelius* and *Cæsius.*

173. Ennius finishes the 12th book of his annals. Attalus of Rhodes, the astronomer and grammarian.

172. A comet appeared in China in the east. See *Hevelius.* Antiochus's first expedition in Egypt.

171. The 2d Macedonian war begins. Antiochus defeats Ptolemy's generals.

170. Paper invented in China. Antiochus plunders the temple of Jerusalem. An irruption of the Tartars into China.

169. Rome contains 212,805 citizens.

168. Perseus defeated by P. Æmilius at Pydna. An eclipse of the moon happened the preceding night, foretold by Gallas. A comet, or, more probably, a meteor, appeared. C. Sulpicius Gallus, the tribune, and the 1st Roman astronomer.

167. The first library erected at Rome, consisting of books brought from Macedon.

166. Terence of Carthage, the comic poet, ob. 159, æt. 35. His first play, Andria, acted at Rome. Apollonius killed by Judas Maccabæus. A globe of fire (*fax*) appeared.

165. Judas purified the temple of Jerusalem. An eruption of Ætna. Crates Mallotes of Pergamus, called the critic. A globe of fire appeared.

164. Rome contained 327,032 citizens. Polybius of Megalopolis, the historian, ob. 124, æt. 82.

163. The government of Judea under the Maccabees begins, and continues 126 years. M. Pacuvius, the tragic poet, ob. about 131, æt. 90.

162. Hipparchus begins his astronomical observations at Rhodes. Demetrius takes possession of Syria.

161. The philosophers and rhetoricians banished from Rome.

160. Terence's last play, Adelphi, acted at the funeral of P. Æmilius. Carneades of Cyrene, ob. 128, æt. 90.

159. Clepsydræ invented by Scipio Nasica.

158. An irruption of the Tartars into China. Hipparchus observed the autumnal equinox on Sunday, September 27, about mid-day.

157. A comet appeared in China in the 9th month.

156. Several temples of Pergamus plundered by Prusias, king of Bithynia. Aristarchus of Alexandria, the great grammarian, ob. æt. 72.

154. A comet appeared. See *Hevelius* and *Lubiniezki.*

152. Andriscus, personating the son of Perseus, assumes the government of Macedon.

150. Demetrius, king of Syria, killed by A. Balas. Aristobulus of Alexandria, the Jew and Peripatetic philosopher, ob. after 124. A very large comet appeared, of the colour of fire. It shone with intense light, and appeared as large as the sun.

149. The 3d Punic war commenced, and lasted three years. Prusias put to death by Nicomedes.

148. Jonathan Maccabæus defeats Apollonius in the battle of Azotus, and takes that city and Ascalon. A comet appeared in the N. part of China, in the 4th month. Satyrus the Peripatetic philosopher and historian.

147. Rome contained 322,000 citizens. The Romans declare war against the Achæans.

146. Carthage destroyed by P. Scipio, and Corinth by L. Mummius. Hipparchus observed the vernal equinox, March 24, at mid-day. A remarkable comet appeared in Greece. It continued visible for 23 days.

145. The Romans desolated Greece.

144. Tryphon murdered Jonathan and his brethren. Antipater of Tarsus, the Stoic philosopher. A very bright comet appeared in Capricorn, and was seen two days.

143. A great earthquake in China.

142. Simon, the high priest, takes the castle of Jerusalem; repairs it, and rescues Judæa from the Syrian yoke.

141. The Numantian war begins, and lasts eight years. An eclipse of the moon observed at Alexandria, on Tuesday, Jan. 17, two hours before midnight.

140. Diodorus, the Peripatetic philosopher.

139. Lucius Accius, the tragic poet flourished.

138. Panatius of Rhodes, the Stoic philosopher.

137. Ptolemy Physcon patronises the arts and sciences. Nicander of Colophon, the physician and poet.

136. Scipio Africanus, &c. made an embassy into Egypt, Syria, and Greece. Ctesibius of Alexandria, the mathematician and inventor of hydraulic instruments. A globe of fire appeared.

135. The history of the Apocrypha ends. A comet appeared in the N. E. part of China in autumn. The war of the slaves begins in Sicily.

133. Numantia destroyed by Scipio. Attalus dies, and Pergamus is added to the Roman empire. Tiberius Gracchus slain.

132. A comet appeared in Gemini, and continued visible for 83 days.

130. Antiochus, king of Syria, defeated and killed. The revival of learning in China. In 129 and 130, a very large comet appeared. It was visible for 70 days, and had a diurnal arc of 4 hours.

129. The temple on Gerizim destroyed by Hreanus.

128. Hipparchus observes the vernal equinox to be on Thursday, March 23d, about sun-set, and afterwards the star *Regulus* was 29° 50′, from the summer solstitial colure. Clitomachus of Carthage, philosopher of the third Academy, ob. about 100.

127. Hipparchus, on May 2d, about sun-rise, observed the sun in 7° 35′ ♉, the moon in 21° 40′ ♓, and their mean distance to be 312° 32′—he observed *Spica Virginis* 6° W. of the autumnal equinoctial point.

124. Apollonius of Nysa, the Stoic philosopher.

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123. Carthage rebuilt by order of the Roman senate. Herodicus called Cratiteus, the grammarian.
122. A very large comet appeared.
121. A great eruption of Ætna. Caius Gracchus killed. L. Cælius Antipater, the Roman historian.
120. A comet appeared in the eastern part of China. Castor of Rhodes, the chronologer and historian.
119. Two comets appeared in China—one in spring in the N. E. and another in summer, in the N. W. A comet appeared for 70 days. Menecrates of Nysa, the grammarian.
118. Narbonne built by a Roman colony. Dalmatia conquered by Metellus.
116. The government of Egypt assumed by Cleopatra. Lucilius, the first Roman satyrist, ob. 103, æt. 46.
115. Apollodorus of Athens, the chronologer and grammarian.
113. Marcus Antonius, sen. the Roman orator, ob. 87, æt 56.
112. The Jugurthine war begins, and lasts five years.
110. A comet appeared in China, in the autumn. Lucius Crassus, the orator, ob. 91, æt. 49.
109. Samaria taken by Hyrcanus. The Teutones and Cimbri attack and defeat Silanus.
108. The Romans defeated by the Cimbri. Athenion, the Peripatetic philosopher, ob. about 95.
107. Cicero is born.
106. Ptolemy dethroned by Cleopatra. Jugurtha given up to Marius.
104. The Cimbri and Teutones defeat the Romans, and kill 80,000 of them on the banks of the Rhone.
103. The Roman people obtain the power of electing the prætors.
102. The Teutones defeated by Marius at Aix—200,000 killed, and 80,000 taken prisoners.
101. Marius and Catullus defeat the Cimbri, of whom 120,000 are killed, and 60,000 taken prisoners.
100. The Agrarian law revived by Saturninus. Julius Cæsar born. Philo, the philosopher of the 3d Academy.
99. The Romans conquer Lusitania. A globe of fire appeared.
97. Ptolemy Appion dies and leaves his kingdom to the Romans. Mesopotamia occupied by the Romans.
96. The king of Parthia sends ambassadors to China.
95. Charmidas, the philosopher of the 3d Academy.
94. Antiochus of Cyzicum defeated by Seleucus.
93. Seleucus defeated by Antiochus the Pious. Apellicon Teius, the proprietor of a famous library at Athens, ob. about 86. An aurora borealis appeared.
91. The Social or Marsic war commences, and is finished by Sylla in 88. L. Sisenna, the Roman historian.
90. A comet appeared in Virgo. Asclepiades of Prusias, the physician, ob. after 63.
89. The Mithridatic war begun. Playfair places it in 94.
88. The civil war between Marius and Sylla begins and continues six years. Alexander Polyhistor, the grammarian and historian.
87. Photius Gallus, the first Latin rhetorician. A comet appeared in the N. W. of China in the spring. Others place it in 84.
86. Athens taken by Sylla, who defeats Archelaus.
85. Diotimus the Stoic philosopher, ob. after 83. Rome contains 464,000 citizens.

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84. Q. Valerius Antias, the Roman historian. Peace between Mithridates and Sylla.
83. Zeno of Sidon, the Epicurean philosopher. Sylla destroyed the Capitol.
82. Sylla plunders the temple of Delphos—defeats Marius—is created dictator. Quintus Hortensius, the Roman orator, ob. 50, æt. 63.
81. A. Lucius Archias, the poet.
80. Antipater of Sidon, the poet.
79. Sylla resigns the dictatorship. Possidonius of Apamea, the Stoic philosopher and astronomer, ob. after 51, æt. 84.
77. Geminus of Rhodes, the astronomer and mathematician.
76. Apollonius of Rhodes, the rhetorician.
75. Nicomedes, king of Bithynia, dies and leaves his kingdom to the Romans. Theodosius of Tripoli, the mathematician.
73. The Servile war begins under Spartacus, &c.
71. Spartacus being defeated by Crassus, the Servile war ends. Tyrannio, the grammarian, ob. after 56.
70. The censorship revived at Rome. M. Terentius Varro, ob. 28, æt. 88. Virgil born.
69. The Roman Capitol rebuilt. Rome contains 450,000 citizens. Lucullus defeats Mithridates. A comet appeared in the west of China in the spring.
68. Aristodemus of Crete, the grammarian.
67. Mithridates defeated by Pompey in Armenia. The war of the Pirates.
66. Crete reduced to a Roman province.
65. The reign of the Seleucidæ ends. And Syria reduced to a Roman province. A very large comet appeared. T. Lucretius Carus, ob. 54, æt. 44.
64. Dionysius of Thrace, the grammarian.
63. Catiline's conspiracy detected by Cicero. Mithridates killed himself. Jerusalem taken by Pompey.
62. Antiochus, the philosopher of the third Academy.
61. L. Taruntius Spurina, the mathematician, ob. after 44.
60. A comet was observed by Possidonius during an eclipse of the sun. The first triumvirate between Pompey, Cæsar, and Crassus. Catullus, the lyric poet, ob. about 40, æt. 46.
59. Andronicus of Rhodes, the Peripatetic philosopher.
58. Cicero banished by the intrigues of Clodius.
57. Cicero recalled from exile. Sallust, the historian, expelled from the senate in 50, ob. 35, æt. 51.
55. Cæsar passes the Rhine, and defeats the Germans. Cæsar's first invasion of Britain. Ptolemy king of Egypt restored. Pompey builds a stone theatre for public amusements.
54. Cæsar's second invasion of Britain. Timagenes of Alexandria, the historian and rhetorician.
53. Crassus killed, and his army defeated by the Parthians. Cratippus, the Peripatetic philosopher.
52. Milo murders Clodius.
51. Gaul becomes a Roman province.
50. The civil war begins, Oct. 22d. Rome contains 320,000 citizens. A comet appeared.
49. Cæsar proclaimed dictator. A comet appeared in China. Cornelius Nepos, ob. about 25.
48. The battle of Pharsalia. Varro the poet.
47. A very large comet appeared. Julius Cæsar retakes Alexandria. The Alexandrian library destroyed.
46. The war of Africa. Cato kills himself at Utica. This year, called the *year of confusion*, was cor-

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rected by Sosigenes of Alexandria, and consisted of 15 months, and 445 days.

45. Battle of Munda. Cæsar rebuilds Carthage and Corinth.
44. Cæsar killed in the senate-house, æt. 56. A comet appeared in China, and at Rome, where it was observed for seven days after Cæsar's death. Diodorus Siculus, the historian.
43. A shower of iron is said by Pliny to have fallen in Lucania the year preceding the defeat of Crassus. The second triumvirate between Octavius, Antony, and Lepidus. Cicero put to death, Dec. 7th.
42. Cassius and Brutus defeated by Antony at Philippi.
41. A great famine at Rome. An earthquake in China. Trogus Pompeius, the historian.
40. Antigonus occupies Jerusalem. Herod receives Judæa from the Romans. Didymus, the scholiast.
39. Syria and Palestine recovered by the Romans.
38. The senate makes 67 prætors.
37. Pompey gained the empire of the sea. Sosius took Jerusalem and Herod. Antigonus put to death.
36. Sextus Pompeius defeated in Sicily. Lepidus degraded from the triumvirate, and banished. Virgilius Maro, ob. 19. æt. 51.
34. Antony seizes Armenia. Marcus Manilius, the astronomical poet.
33. Dioscorides, physician to Antony and Cleopatra.
32. A comet appeared in China.
31. The battle of Actium, Sept. 2d. Antony and Cleopatra defeated. An earthquake in Judæa. Asinius Pollio, the orator and historian, ob. A. D. 4. æt. 80.
30. Alexandria taken by Octavius. Antony and Cleopatra put themselves to death. Egypt reduced to a Roman province. Strabo, the geographer, ob. A. D. 25. In this and the following year a comet appeared in Libra, and was seen for 29 days.
29. Horatius Flaccus, ob. 8. æt. 57. Cæsar triumphed three days in Rome. Temple of Janus shut. Rome contains 4,101,017 citizens.
28. Æmilius Macer, of Verona, the poet, ob. 16.
27. The title of Augustus and of Emperor for 10 years conferred upon Octavius, by a decree of the senate. The Pantheon at Rome built. A great famine in Palestine. S. Aurelius Propertius, the elegiac poet. A comet appeared. See *Hevelius.*
25. The Egyptians adopt the Julian year, and fix their Thoth to begin always on Aug 29th. Titus Livius, ob. A. D. 17. æt. 76.
23. A large comet was seen this year. Antonius Musa, the physician.
22. A great pestilence in Italy.
21. Augustus recals Agrippa, and gives him Julia in marriage. Tibullus, the elegiac poet, ob. about 19 æt. 24.
20. Tiberius recovers the Roman ensigns from the Parthians. Porus, king of India, solicits an alliance with Augustus. Ovidius Naso banished to Tomi, A. D. 9. ob. 17. æt. 59.
19. Rome at the meridian of its glory. The temple of Jerusalem rebuilt by Herod. Agrippa constructed the aqueducts at Rome.
18. Augustus reduces the senate to 300; and afterwards limits them to 600.
17. The Secular games revived. Varius and Tucca, critics and editors of the Æneid.

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16. Agrippa goes to Syria, and thence to Judæa.
15. The Rhætians defeated by Drusus. M. Vitruvius Pollio, the architect.
14. A great conflagration at Rome.
13. The office of Pontifex Maximus assumed by Augustus, who burns 2000 pontifical books, reserving those of the Sibylline oracles.
12. A comet was seen for several days near Rome. Tiberius conquers the Pannonians. Nicholas Damascenus, the philosopher. Agrippa dies.
11. Drusus conquers several German nations.
10. The city of Cæsarea built by Herod.
9. Drusus's expedition into Germany, where he dies, July 20th. C. Julius Hyginus, the grammarian and poet.
8. Augustus corrects the calendar. Rome contains 4,233,000 citizens. Verrius Flaccus, the grammarian, and tutor to Augustus's grandsons.
6. Tiberius, jealous of the two Cæsars, retires to Rhodes.
5. Q. Varus appointed governor of Syria. A comet appeared in China. Our SAVIOUR born, on Monday, Dec. 25th, or Sept. four years before the common æra. Cyrenius appointed governor of Judæa. Dionysius of Halicarnassus, the historian.
4. An eclipse of the moon observed at Jerusalem, March 13th, middle 2 hours 45′ after midnight.
2. Julia banished by Augustus. Dionysius the geogr.
1. An interview between Caius Cæsar and Tiberius. A comet appeared.

FIRST CENTURY.

A. D.

1. C. Cæsar makes peace with the Parthians.
2. Tiberius returns to Rome. L. Cæsar dies.
3. C. Cæsar dies. Cinna's conspiracy detected.
4. Leap year corrected. Phædrus flourished.
6. A great famine at Rome.
7. Germanicus marches against the Pannonians.
8. JESUS CHRIST disputes in the temple. Asinius Gallius, ob. 33. Germanicus, ob. 19. æt. 34.
9. The Romans subdue Dalmatia.
10. In this year, or in the year 12, a comet was seen in Aries for 32 days. The Romans defeated by Arminius, a German general.
13. A comet appeared in China.
14. Rome contains 4,037,000 citizens. Augustus dies at Nola Aug. 19th, æt. 76.
15. Valleius Paterculus, ob. 31.
16. Mathematicians and magicians expelled from Rome.
17. Cappadocia reduced to a province. An earthquake destroys 12 cities in Asia. Cornelius Celsus.
18. Tiberius built by Herod.
19. Jews banished from Rome.
21. Theatre of Pompey consumed by fire. A comet appeared in China.
23. Valerius Maximus.
26. Tiberius goes to the island Capræa. John the Baptist begins his ministry.
27. A conflagration at Rome. Pilate made governor of Judæa, kills himself, 39. JESUS baptised by John.
32. Columella flourished.
33. Our SAVIOUR JESUS CHRIST crucified on Friday, April 3d, at 3 o'clock P. M. Resurrection on Sunday, April 5th. Ascension, Thursday May 14th.
36. St Paul converted.
37. Tiberius dies after a reign of 23 years, æt. 78.

A. D.

39. A conjunction of Saturn, Jupiter, and Mars. St Matthew, according to Blair, writes his gospel. Philo Judæus flourished.

40. The name of Christians given at Antioch. Petronius appointed governor of Syria. A comet appeared in Gemini.

41. Caligula assassinated by Chereas.

43. Claudius's expedition into Britain.

44. Peter imprisoned. James put to death. St Mark, according to Blair, wrote his gospel.

45. Vespasian's successful war in Britain. Pomponius Mela, the geographer.

47. A new island appeared in the Ægean Sea. The secular games celebrated at Rome. Caractacus the British king.

48. A comet appeared. See *Lubiniezki.*

50. London built by the Romans about this time.

51. Caractacus carried in chains to Rome. A comet appeared.

52. The council of the apostles at Jerusalem. Astrologers expelled Italy. Paul preaches at Athens.

54. In 54 or 56, a comet appeared in Cancer. It was visible during 4 months, and moved from the north to the east. Claudius dies. Nero succeeds.

55. Cæsar landed in Britain. Aug. 26, a comet appeared in China. Paul preached at Ephesus.

56. Rotterdam built about this time.

57. A comet appeared in 57 or 58. Persius, ob. 62, æt. 30.

59. Nero caused his mother Agrippina to be put to death. Paul's defence before Felix.

60. A comet appeared at Rome, and in China. It was seen for 6 months in great brilliancy. The Christian religion published in Britain. Paul's defence before Festus.

61. Boadicea defeats the Romans, but soon after is conquered by Suetonius. A comet appeared. Petronius Arbiter, ob. about 66.

62. St Paul sent in bonds to Rome. In 62 or 64 a comet appeared.

63. A great earthquake in Asia.

64. A conflagration in Rome. The first persecution of the Christians. Quintus Curtius.

65. Prodigies seen at Jerusalem. Seneca, Lucan, and others put to death.

66. Nero goes into Greece. The Jewish war begins in May. A comet appeared. Pliny the historian, ob. 79.

67. St Peter and St Paul put to death about June 29th. Vespasian defeats the Jews, and takes Josephus prisoner.

68. A comet appeared. Nero dies.

69. Galba put to death. Otho kills himself. A comet appeared in Jerusalem.

70. Titus destroys Jerusalem, Saturday, Sept. 8. The lands of Judæa sold by the Romans. A comet appeared in Gemini.

71. Josephus, ob. 93, æt. 56.

72. A comet appeared in Libra, and was seen for 40 days.

73. The philosophers expelled from Rome by Vespasian. A comet appeared. Frontinus flourished.

74. The states of Achaia, Lycia, Samos, Thrace, &c. formed into separate provinces. Silius Italicus, ob. æt. 75.

75. Vespasian dedicated a temple to Peace. A comet appeared in China.

76. A comet appeared. Asconius Pedianus, ob. æt. 85.

A. D.

77. A comet appeared in China. A great plague at Rome. The Parthians revolt.

79. Vespasian dies. Herculaneum and Pompeii are buried by an eruption of mount Vesuvius, Nov. 1. In 78 or 79 a comet appeared for 6 months.

80. The Capitol, Pantheon, &c. of Rome consumed by fire. Titus builds the hot baths and amphitheatre.

81. A comet appears. Titus dies. Martial, ob. 104, æt. 75.

82. Agricola reduces South Britain to a Roman province. Domitian banishes all the philosophers from Rome. Apollonius Tyanæus, ob. 97.

84. Valerius Flaccus flourished.

85. Britain discovered to be an island.

86. Domitian instituted the Capitoline games. Solinus.

88. The secular games celebrated. The Dacian war begins. Epictetus, the Stoic philosopher, ob. about 161.

89. Quintilian, ob. about 95.

90. Agrippa of Bithynia, the mathematician.

91. Statius of Naples, the poet, ob. 96. St Clement I.

92. A vestal buried alive for prostitution. Agrippa observes in Bithynia a conjunction of the moon with the Pleiades, Nov. 29, 5^h before midnight. St Ignatius, ob. 108.

93. The empire of the Huns, in Tartary, destroyed by the Chinese. Tacitus the historian, ob. after 99. John banished to the island of Patmos.

95. The 2d persecution of the Christians under Domitian. Juvenal, ob. 128.

96. Domitian put to death.

97. The evangelist John returns from exile; ob. 99, æt. 92.

98. Nerva dies. Menelaus, the mathematician, observed at Rome a transit of the moon over *Spica Virginis* Jan. 11, 5^h after midnight.

99. Julius Severus, governor of Britain.

SECOND CENTURY.

102. Pliny, pro-consul in Bithynia, sends Trajan his account of the Christians.

103. Dacia reduced to a Roman province. Pliny junior.

105. A great earthquake in Asia and Greece. Dion Prusæus flourished.

106. Trajan marches against the Parthians, &c. Philo-Byblius, ob. 133, æt. 80.

107. The 3d persecution of the Christians under Trajan.

109. A comet appeared in China. Plutarch, ob. 119.

111. Suetonius, the historian, ob. after 117.

114. Trajan erects his column at Rome. A great earthquake in China. Ælian, ob. about 140, æt. 40.

115. Trajan subdues Assyria. An earthquake at Antioch.

116. The Jews make an irruption into Egypt. L. Annæus Florus.

117. Adrian marches into Britain. Trajan dies. Theon, senior, the astronomer of Smyrna.

118. The 4th persecution of the Christians, under Adrian.

120. Nicomedia and other cities destroyed by an earthquake.

121. Adrian builds a wall between Carlisle and Newcastle.

126. Adrian goes into Asia and Egypt for 7 years.

127. Aristides flourished.

128. In 128 or 130 a comet appeared in Aquarius and Capricorn, and was seen 39 days. Cæsarea and Nicopolis destroyed by an earthquake.

130. Adrian rebuilds Jerusalem, and erects a temple to

A. D.

Jupiter. At Alexandria, Ptolemy observed Mars in opposition, Dec. 14, 3^h P. M.
131. The Jews commence a second war. St Polycarp, ob. 167.
132. Ptolemy observed the autumnal equinox, Sept. 25, 2^h P. M.
133. An eclipse of the moon observed by Ptolemy at Alexandria, on Tuesday, May 6, 11^h 45′ P. M. He observed Jupiter in 13° 15′ ♉, May 17, 11^h P. M. and Saturn in 9° 40′ ♐, June 4, 4^h P. M. Ptolemy, the mathematician, ob. 161.
134. Urbicus's wall was built between Edinburgh and the Firth of Clyde. Marcion, the heretic. Ptolemy observed Venus in 11° 5′ ♑, Feb. 16, morning; and Mercury in 20° 12′ ♍, Oct. 3, morning.
135. The Jewish war ends, and almost all the Jews banished from Judæa.
136. The second great canicular year of the Egyptians begins, July 20. Arrian, the historian and philosopher.
138. Adrian dies at Baiæ. Ptolemy observed Regulus in 2° 30′ of this sign, and 32° 40′ from the summer solstice.
139. Justin Martyr writes his first Apology for the Christians, ob. 163.
140. Ptolemy observed Venus in 18° 30′ ♊, and 47° 15′, from the mean place of the sun, July 18. Observed the vernal equinox at Alexandria, March 22, about 1 o'clock afternoon.
141. A comet appeared in China.
144. Appian, the historian.
145. Antoninus defeats the Moors, Germans, and Dacians. In 145 or 146 a comet was seen 6 days in Aquarius. Polyænus.
146. The worship of Serapis introduced at Rome by the emperor, and his mysteries celebrated May 6. Artemidorus.
147. Apuleius flourished.
148. Justin, the historian.
149. A comet appeared in China. Aulus Gellius, the grammarian.
151. Maximus Tyrius, ob. about 180.
152. An earthquake at Rhodes. An inundation of the Tiber, &c. Antoninus stops the persecution against the Christians.
153. Pausanias, ob. after 173.
156. Diophantus, ob. æt. 84.
158. Lucian, ob. about 180, æt. 90.
159. The Bactrians and Indians submit to Antoninus.
160. A comet appeared.
161. Antoninus Pius dies, æt. 75.
162. War with the Parthians continues three years.
163. The Christians persecuted under Marcus Aurelius Antoninus, called by some the 4th. Galen, ob. 193, æt. 70.
165. A comet appeared.
166. The Romans send ambassadors to China.
168. A plague over the known world. Athenagoras, ob. 177.
169. The war with the Marcomanni begins.
171. Montanus propagated his heresy. Tatian.
172. Athenæus of Naucratis, author of the *Deipnosophistæ*, ob. about 194.
174. War with the Marcomanni, Vandals, &c. finished.
177. Another war with the Marcomanni, which lasts three years.
178. Diogenes Laertius, ob. about 222.
180. Marcus Aurelius dies, æt. 59.

A. D.

181. Commodus makes peace with the Germans. A comet appeared.
182. A comet appeared in China. St Irenæus, ob. 202.
183. A violent war in Britain finished by Marcellus.
186. Julius Pollux, ob. æt. 58.
188. The Capitol, &c. of Rome destroyed by lightning. A comet appeared in China.
189. A plague at Rome. The Saracens defeat the Romans.
191. Rome nearly destroyed by fire.
192. Commodus is put to death, æt. 31. A comet appeared.
193. Different persons usurp the empire on the death of Pertinax.
194. Severus besieges Byzantium.
195. A comet appeared.
198. Albinus defeated by Severus, and killed at Lyons.
200. A shower of a substance which converted copper into silver, is said by Dion to have fallen for three days during the lifetime of Severus. Severus defeats the Parthians. A comet appeared in China.

Third Century.

201. Papinianus, ob. 212.
202. The 5th persecution of the Christians, under Sept. Severus. A comet appeared at Rome. An eruption of Vesuvius.
204. The secular games celebrated at Rome. A comet appeared in China, and was seen several days.
205. An earthquake in Wales.
206. A comet appeared in China, near the polar star. Clemens Alexandrinus.
207. Severus goes into Britain, and 50,000 of his troops die of the plague. Minutius Felix.
209. Severus builds his wall across Britain.
210. Philostratus, ob. about 244.
211. Severus dies at York, æt. 66.
212. A comet appeared in China. Christianity introduced into Scotland. Caracalla kills his brother Geta, and many others.
213. Oppian, ob. æt. 30.
216. War between the Romans and Parthians.
217. Caracalla killed by Maximus, æt. 43. The Septuagint found in a cask.
218. Maximus put to death by the soldiers. A comet appeared in China; it went from east to west, and was seen several days at Rome.
220. Julius Africanus, the chronologer. A comet appeared in Pisces, and was seen for 18 days.
222. The Romans agree to pay an annual tribute to the Goths.
225. Mathematicians allowed to teach publicly at Rome.
226. Parthia becomes tributary to Persia.
229. The Arsacides terminate in Persia. Dion Cassius, the historian.
231. Origen, ob. 254, æt. 69.
232. Ammonius, the Christian and Platonic philosopher, begins a school of Platonic philosophers at Alexandria, ob. after 243.
233. The Persians defeated by the Romans with great slaughter, at Tadmor.
235. The 6th persecution against the Christians.
236. Two comets appeared in China.
237. The two Gordians killed in Africa.
238. Censorinus flourished.
241. The Franks first mentioned in history. Gregory Thaumaturgus, ob. 266.
242. Gordian makes a successful expedition against the Persians.

A. D.

244. Gordian is put to death.

245. Peace between the Romans and Persians.

247. The secular games celebrated at Rome. Herodian, the historian.

249. The two Philips are killed; one at Verona, the other at Rome.

250. The seventh persecution of the Christians, under Decius.

251. The Romans are defeated by the Goths at Mæsia. St Cyprian, ob. 258.

252. The Romans become tributary to the Goths. Asia invaded by the Scythians and Persians. A dreadful pestilence over the Roman empire.

254. Plotinus, ob. 270, æt. 66. A great eruption of Ætna.

257. The 8th persecution of the Christians, under Valerian.

258. The Roman empire is harassed by 30 tyrants.

260. Valerian flayed alive by Sapor, king of Persia. The temple of Diana burnt. The Roman empire ravaged by the Scythians.

261. A great plague raged in the Roman empire. Longinus, ob. 273.

262. Earthquakes in Europe, Asia, and Africa; and 3 days of darkness. Paulus Samosatenus, bishop of Antioch, deposed in 270.

264. Odenatus, king of Palmyra, governs the eastern empire.

267. The Romans defeat the Scythians and Goths.

268. Gallienus is killed at Milan, æt. 50.

269. Claudius conquers the Goths, and kills 300,000. Egypt occupied by Zenobia.

272. The 9th persecution of the Christians, under Aurelian.

273. Zenobia defeated by Aurelian, and Palmyra taken.

274. The temple of the Sun built at Rome. Dacia given up to the Barbarians by Aurelian.

275. Aurelian is killed near Byzantium.

276. Wines first made in Britain. Tacitus dies at Tarsus. Porphyry, ob. about 304, æt. 71.

277. Probus marches into Gaul. The Franks settle in Gaul. A comet appeared in China.

280. The Persians defeated by Probus.

282. Probus is put to death at Sirmium.

284. The æra of Dioclesian begins Aug. 19, according to the fixed Egyptian year, though his reign did not begin till Sept. 17. Ambassadors sent to China by the Romans.

285. Arnobius flourished.

286. The empire attacked by northern nations, and several provinces are usurped by tyrants.

287. Carausius proclaimed emperor in Britain.

289. A great comet visible for 20 days, in Mesopotamia. Gregory and Hermogenes, lawyers.

290. The Gregorian and Hermogenian codices published.

291. The two emperors and the two Cæsars march to defend the four quarters of the empire. Ælius Spartianus, the historian.

293. Carausius killed by Alectus. The Franks expelled from Batavia.

296. Britain recovered to the emperors after a ten years usurpation. Dioclesian besieges and takes Alexandria.

Fourth Century.

301. War between the Persians and Romans. Julius Capitolinus.

A. D.

303. The 10th persecution of the Christians, under Dioclesian. Flavius Vopiscus.

304. Dioclesian and Maximianus resign the empire.

305. A comet appeared in China. Trebellius Pollio.

306. Constantius wages war against the Britons: dies July 25.

307. A considerable part of Rome consumed by fire. Ælius Lampridius. In 307 or 308 a comet appeared.

308. Four emperors reigned at the same time.

309. The Christians persecuted in the East.

310. Britain divided into four governments by Constantine.

311. Lactantius flourished.

312. Maxentius killed in battle. Pestilence over the East.

313. The 10th persecution of the Christians terminated by an edict of Constantine and Licinius.

314. A civil war between Constantine and Licinius.

315. Crucifixion abolished.

319. Constantine protects the Christians.

321. Sunday appointed to be observed.

323. Constantine obtains possession of the empire, and tolerates Christianity.

324. Licinius defeated and banished. In 322 or 324 a comet appeared in Virgo.

325. The 1st general Council of Nice, from June 19, to Aug. 25, consists of 318 bishops. Arius, ob. 336.

326. Crispus put to death. The Christians persecuted by the Parthians. Eusebius Pamphilus, ob. 342.

328. The seat of empire transferred from Rome to Constantinople.

330. Constantinople solemnly dedicated. A dreadful persecution in Persia, which lasted 40 years.

331. The heathen temples demolished by order of the emperor. St Athanasius, ob. 371.

333. A great famine and pestilence in Syria.

334. 300,000 Sarmatians revolt, and are dispersed through the empire.

336. A very large comet appeared in China.

337. Constantine the Great dies May 22, æt. 66.

340. Constantine, junior, killed at Aquileia. An earthquake in the East. A large comet appeared in Aries, and was seen 183 days.

341. Christianity propagated in Ethiopia by Frumentius. St Hilary, ob. 367, æt. 80.

342. Jamblichus, ob. about 363.

344. Neocæsarea destroyed by an earthquake.

350. Constans killed in Spain.

353. Ælius Donatus, the grammarian.

354. Constantius puts Gallus to death.

356. Eutropius, the historian and sophist.

357. Six German kings defeated at Strasburg by Julian.

358. 150 cities in Greece and Asia destroyed by an earthquake. Libanius, the sophist.

359. Ammianus Marcellinus, ob. about 380.

361. Constantius dies at Tarsus, æt. 45. Gregory Nazianzen, ob. 389.

362. Themistius, the sophist, ob. about 386.

363. Julian in vain endeavours to rebuild the temple of Jerusalem; and dies in an expedition into Persia. Aurelius Victor. A comet appeared.

364. The Roman emperors enacted laws against magicians. Briton harassed by the Picts, Scots, and Saxons. The Roman empire divided into two parts, called the Eastern and Western empire.

370. Valens marched against the Persians. St Basil, ob.

A. D.
379, æt. 51. A comet appeared in Aries, and was seen 11 weeks.
372. Eunapius.
373. The Bible translated into the Gothic tongue. A comet appeared in China.
374. St Ambrose made bishop of Milan, ob. 397.
376. The Goths, expelled by the Huns, settle in Thrace.
377. A comet appeared.
378. Valens defeated by the Goths. The prerogatives of the Roman see much enlarged.
379. The Lombards first leave Scandinavia, and defeat the Vandals. Ausonius, ob. about 394.
380. A comet appeared in Libra. It was seen from May till September, and was brighter than Venus.
381. The 2d general council of Constantinople. Macedonius, the heretic.
383. The emperor Gratian defeated and killed. The Huns ravaged Mesopotamia. Pappus of Alexandria, the mathematician. A comet appeared.
385. Theon, jun. of Alexandria, the mathematician.
387. The Quinquennales celebrated by Arcadius. St Jerome, ob. 420, æt. 78.
388. The tyrant Maximus defeated and killed by Theodosius.
389. The first kings of the Lombards elected in Pannonia. A comet appeared in Gemini, and was seen for 20 days.
390. A fiery column seen in the air for 30 days.
392. Prudentius. In 392 or 393 a large comet appeared; in 40 days it moved from Venus to the Great Bear.
394. Theodosius defeats Eugenius and Arbogastes. St Augustine, ob. 430, æt. 76. A great earthquake felt in many parts of Europe. A large comet appeared.
395. Theodosius the Great dies, æt. 60.
396. St Chrysostom, ob. 407, æt. 53. A comet appeared.
397. Claudian.
398. Heliodorus.
400. A large comet appeared in China.

Fifth Century.

401. Europe overrun by Alaric, king of the Goths. Sulpicius Severus, the ecclesiastical historian, ob. 420.
402. The Avari obtain possession of Great Tartary after defeating the Huns. Anianus of Alexandria, the monk and chronologer.
403. Stilicho defeats Alaric. Macrobius; ob. about 415.
404. An irruption of the Goths. Panodorus of Alexandria, the monk and chronologer.
405. John Stobæus. Stilicho defeats 200,000 Goths. A very large comet appeared.
406. The Vandals, Alani and Suevi, spread into France by a concession of Honorius. Pelagius, ob. about 430.
408. Christianity propagated in Persia. Hypatia, the mathematician, and daughter of Theon, ob. 415. A comet appeared during a solar eclipse.
410. Rome taken and plundered by Alaric. Servius, the commentator on Virgil. A comet appeared.
411. Synesius, bishop of Cyrene, and Platonic philosopher.
412. The Vandals begin their kingdom in Spain. Armenia divided between the Persians and Romans. St Cyril, bishop of Alexandria, ob. 444. A comet was seen in Capricorn from summer till the end of autumn.
413. The kingdom of the Burgundians begins in Alsace. A comet was seen in Virgo for four months.
414. The Visigoths establish the kingdom of Thoulouse.
415. The Christians persecuted in Persia.
416. A meteoric stone fell in Constantinople. Orosius, the historian.
417. The Goths extirpate the Alans.
418. A comet was seen from summer till September.
419. Many cities in Palestine destroyed by an earthquake. Socrates, the ecclesiastical historian.
420. The kingdom of the French begins on the Lower Rhine. China is divided into two empires.
421. The Salic law promulgated. Christianity persecuted in Persia.
422. Thrace ravaged by the Huns.
423. John the Notary usurps the western empire. A comet was seen for several days.
425. Theodosius establishes public schools at Constantinople.
426. The Romans leave Britain.
427. The Romans recover Pannonia. Zosimus, the historian.
428. Ætius the Roman general defeated by the French.
431. The third general council of Ephesus. Nestorius, the heretic bishop of Constantinople.
432. The Vandals occupy the Roman provinces in Africa.
433. A great part of Constantinople consumed by fire.
434. A comet appeared.
435. Nestorianism prevails in the East. The Theodosian codex published.
437. Ætius defeats the Goths. Cyril's cycle of 95 years begins. The Christians first persecuted by the Vandals. Theodoret, bishop of Cyrus, ob. about 460.
439. Genseric takes Carthage; and the kingdom of the Vandals begins in Africa. Sozomen, the ecclesiastical historian, ob. 450.
441. The Roman territories invaded by the Huns, Persians, and Saracens.
442. A comet appeared.
443. The Manichæan books burned at Rome. Olympiodorus, the ecclesiastical historian.
446. The Britons complain to Ætius and the Romans, against the incursions of the Scots and Picts.
447. Attila ravages Europe.
448. A comet appeared.
449. The Saxons arrive in Britain, and land in the isle of Thanet. Heptarchy established in England. A great famine in Italy.
450. Theodosius II. dies, æt. 49. A comet appeared.
451. The fourth general council of Chalcedon. Ætius defeats Attila. The Christians persecuted in Britain. A comet appeared. Eutyches.
452. The city of Venice takes its rise about this time.
454. The Britons attempt in vain to expel the Saxons. The Vandals occupy Sicily.
455. Rome taken by Genseric.
456. Theodoric defeats the Suevi. Prosper, ob. 460.
457. Hengist defeats Vortimer in the battle of Crayford, Kent.
458. A great earthquake at Antioch. The Chinese sail to the north of California.
461. A fire in Constantinople. Peace between the emperor Leo and the Goths.

A. D.
463. The paschal cycle of 532 years invented by Victorius, of Aquitain.
464. The Vandals expelled from Sicily.
466. The Romans defeat the Goths. Rogation-day instituted.
467. The Romans defeat the Vandals.
468. The Romans driven by the Visigoths out of Spain.
469. Sidonius Apollinaris, ob. 482, æt. 52.
472. A great eruption of Vesuvius.
474. Leo I. and Leo II. die.
475. Three hundred British nobles treacherously massacred by Hengist. The Romans defeat the Saxons. Gelasius, of Cyzicum.
476. The kingdom of Italy begins. The western empire ended. A dreadful fire in Constantinople.
479. Peter, sirnamed the Fuller, ob. 486.
480. An earthquake which lasts 40 days, destroys the greater part of Constantinople.
484. Christianity persecuted by Huneric king of the Vandals.
485. The Romans defeated at Soissons by Clovis.
487. The Saxons defeated by the Britons under Ambrosius and prince Arthur.
490. Odoacer defeated by Theodoric.
491. Ella founds the second Saxon kingdom of Sussex.
493. The kingdom of Italy transferred from the Heruli to the Ostro-goths, by the capture of Ravenna. Malchus, the sophist.
494. The Roman pontiff asserts his supremacy.
495. Timotheus Gazæus.
496. Clovis baptized, and Christianity received in France. Poland and Bohemia occupied by the Sclavonians.
497. The Isauric war closes.
499. Thrace ravaged by the Bulgarians. Fulgentius, ob. 529.
500. Syria and Phœnicia ravaged by the Saracens.

Sixth Century.

501. Anastasius makes peace with the Saracens. Gondebaud publishes his laws of the Burgundians.
503. Cabades, king of Persia, destroys Anastasius's army. The Pope resists the legal magistrate.
504. Christianity persecuted by the Vandals. The Pandects published. Magi prevail at Rome.
505. The Persian war ends.
506. The Theodosian code reformed and published by Arien.
507. Alaric defeated and killed by Clovis, near Poitiers.
509. A great fire at Constantinople. Arabia and Palestine invaded by the Saracens. Alcimus Avitus, ob. 523.
510. Paris becomes the capital of the French dominions.
511. A great insurrection at Constantinople. The Saxons defeated in the battle of Badon-hill or Bath, by Prince Arthur.
512. An eruption of Vesuvius.
513. Christianity embraced by the Persian and Saracen kings. Boetius, the philosopher, ob. 524.
514. Constantinople besieged by Vitalianus, whose fleet is consumed by a burning mirror of Proclus. Cassidorus, secretary to Theodoric, ob. 562, æt. about 100.
516. Macedonia, Thessaly, &c. ravaged by the Getæ. The computation of time by the Christian æra introduced by Dionysius the monk, called the Little, ob. 540.
517. Five years drought and pestilence in Palestine.

A. D.
518. Anastasius killed by lightning, æt. 88.
519. Prince Arthur defeated at Charford by Cerdic, which begins the third Saxon kingdom of Wessex.
520. The Anglo-Saxons defeated at Bath by the Britons.
521. An earthquake at Corinth. Hesychius of Miletus.
522. The Moors defeat and kill Thrasamond, king of the Vandals.
524. An earthquake in Cilicia.
525. Antioch destroyed by fire. Priscian, the grammarian.
526. An earthquake at Antioch.
528. Belisarius marches against the Persians.
529. The code of Justinian published. The order of Benedictine monks instituted. Tribonianus, the famous lawyer.
532. A conspiracy at Constantinople. A great pestilence in Ethiopia. The kingdom of Burgundy conquered by Childebert and Clotaire.
533. The digest of Justinian published. Belisarius sent against the Vandals in Africa. In 531 or 533, a comet appeared during twenty days.
534. The kingdom of the Vandals finished by Belisarius, who took Carthage. Procopius, the historian.
535. Belisarius gains Sicily. A comet seen in Sagittarius, in December.
536. Belisarius takes Naples. The inhabitants of Constantinople taught by two Indian monks to fabricate silk.
537. Rome surrendered to Belisarius. French coin begins to be current through the Roman empire. Count Marcellinus, the chronologer.
539. Italy distressed with war, famine, and pestilence. The city of Milan razed by the Goths. Theodobert takes the camps of the Romans and Goths.
540. Vitiges taken by Belisarius in Ravenna. The Moors defeat the Romans. The king of Persia destroys Antioch.
541. Jornandes, the Gothic historian, ob. 552.
542. Prince Arthur murdered in Cornwall. Antioch rebuilt. The Goths defeat the Romans on the Po.
543. Asia and Europe desolated by the plague. An earthquake of great extent, Sept. 6th. Totila, king of the Goths, seizes Tuscany, Campania, Puteoli, Naples, &c.
544. The Persians defeat the Romans.
546. Totila takes and pillages Rome. Simplicius, the Peripatetic philosopher.
549. Rome fortified by Totila.
550. An earthquake in Palestine, Syria, &c. The state of Poland formed by Leck.
551. The manufacture of silk brought from India into Europe.
552. The empire of the Avars in Great Tartary ends. An earthquake in Greece, and a great commotion in the sea. A great earthquake at Constantinople. The fifth general council, or second of Constantinople, held.
553. Totila defeated by Narses, and killed.
554. Narses defeats and kills Teia, king of the Goths.
556. A sedition of the Jews in Palestine. Civil wars in France. Gildas, the historian, ob. 570.
557. A great earthquake at Rome, Constantinople, &c.
558. A plague in Europe, Asia, and Africa, which lasts near 50 years.
559. The Heptarchy began in England.

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560. A comet appeared, and was observed for a year.
561. A conspiracy against Justinian. Belisarius disgraced, but restored the next year.
563. Constantinople almost consumed by fire.
565. Pestilence in Italy, France, and Germany. Columbus propagates Christianity among the Picts. Justinian dies, æt. 83. Agathias, the historian.
567. The kingdom of the Visigoths founded in Spain.
568. The Lombards, invited from Pannonia by Narses, found a kingdom in Italy.
569. The Turks first mentioned in history. Exarchs sent by the eastern emperors to Ravenna against the Lombards.
572. The Persians declare war against Justin. Gregory of Tours, ob. 595.
573. Part of Germany ravaged by the Avari.
574. The Persians invade and plunder Syria.
575. Civil wars in France. The first monastery founded in Bavaria.
576. Chosroes defeated by Justin's army.
578. Justin II. dies.
580. Chosroes again defeated, and dies of grief. The city of Antioch destroyed by an earthquake.
581. Latin ceased about this time to be spoken in Italy.
583. The Suevi in Spain subdued by the Visigoths.
584. The origin of fiefs in France.
587. An earthquake at Antioch.
588. The city of Paris destroyed by fire.
589. The Tiber inundates Rome. The provinces of China united. Philippicus defeated the Persians. A comet appeared.
590. Pestilence in Italy and France. The Avari defeat the Romans.
592. Ceaulin defeated in the battle of Wanburgh.
593. The Avari expelled from Thrace.
594. Evagrius, the ecclesiastical historian. A comet appeared.
595. Istria, Bohemia, and Poland, invaded by the Sclavonians. The Lombards besiege Rome, and ravage Italy.
596. John, of Constantinople, assumes the title of universal bishop.
597. Augustin arrives in England with 40 monks.
598. A truce between the Romans and Lombards.
599. A dreadful pestilence in Africa. A comet appears in France.
600. Italy ravaged by the Sclavonians and Avari.

SEVENTH CENTURY.

601. A comet was seen for several days.
602. Mauritius, killed by Phocas. The Romans defeated by the Lombards.
603. War between the Persians and Greeks. Secundus, historian of the Lombards, ob. 615.
604. Chosroes defeats the Roman army. St Paul's church founded by Ethelbert, king of Kent.
605. Bells introduced into churches. The papal power begins.
606. The court of chancery instituted in England.
609. Revolt of the Jews in Antioch, who massacre the Christians. Isidorus Hispalensis, ob. 636.
610. Heraclius, after taking Constantinople, kills Phocas.
611. Westminster Abbey founded by Sibert, king of the East Saxons.
612. Syria ravaged by the Saracens. Mahomet publishes his Koran. Theophylactus Simocatta, the historian.
613. Clotaire reigns over all France.

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614. Jerusalem taken by the Persians, who kill 90,000, and carry off the cross of Christ.
615. The Persians over-run Africa, and take Alexandria.
616. Carthage taken and plundered by the Persians. The Jews banished from France and Spain.
617. Edwin kills Ethelfred in the battle of Retford. John of Alexandria, called Philoponus, the grammarian, and commentator on Aristotle.
618. Constantinople taken and pillaged by the Avari.
622. Heraclius defeats the Persians in a great battle. Mahomet fled from Mecca to Medina, and the Hegira begins on Friday, July 16. Mahomet ob. 63, æt. 63. Heraclius dies, 641.
628. An academy founded at Canterbury. Chosroes killed by his son.
632. The æra of Jesdegird commences, June 16.
633. Edwin, king of Northumberland, killed in battle by Penda, king of Mercia. A large comet appeared.
634. Damascus taken by the Saracens. Geo Pisides, the poet and historian, ob. after 641.
635. The Saracens invade Egypt and Palestine. Pens made from quills.
636. Christianity introduced into China.
637. Jerusalem taken by the Saracens.
640. The Saracens take Alexandria, and burn the library.
644. Omar killed in the temple of Jerusalem. The university of Cambridge founded by Sigebert, king of East Anglia.
647. The Saracens make themselves masters of Africa.
648. Cyprus taken by the Saracens.
652. Persia becomes a part of the empire of the Caliphs.
653. The Saracens destroy the Colossus of Rhodes, ravage Armenia, and defeat the Greeks at sea. The Danes invade England.
659. The Saracens obtain peace of Constans, on condition of paying him 100,000 crowns yearly.
660. Organs first used in churches.
663. The kingdom of Lombardy taken possession of by Grimoald, duke of Beneventum.
668. Constans murdered in a bath.
669. Sicily ravaged by the Saracens.
671. The Saracens invade Syria, besiege Constantinople, &c.
673. The Greeks defeat the Saracens, and disperse their fleet. Callinicus, the mathematician.
674. Glass introduced into England by a Benedictine monk. Others say in 663.
675. The Saracens attempting to land in Spain, are defeated by Wamba.
676. The Saracens make a peace with Constantine, on paying an annual tribute. A comet appeared at Rome.
680. The sixth general council of Constantinople.
681. Pestilence in Saxony, and next year in Syria.
684. Egfrid invades Ireland, but is defeated. A comet appeared at Rome in January. An eruption of Vesuvius.
685. Constantine V. dies. The Saxons completely subdue the Britons.
690. Pepin engrosses the power of the French monarchy.
694. A conspiracy of the Jews in Spain. Justinian II. banished with the loss of his nose.
695. Money first coined by the Arabians.
697. Christianity propagated in the eastern parts of France. Leontius deposed.

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698. Carthage taken by the Saracens, who expel the Romans from Africa. The Picts in Britain embrace Christianity. Christianity introduced into Friesland. The first prince of Poland elected, and Cracow built.

Eighth Century.

703. Justinian seizes Thrace, and marches to Constantinople.
704. The Lombards reduced by intestine wars.
706. The Bulgarians defeated by Justinian.
707. The Saracens invade the Roman territories.
709. Ina published the laws of the Saxons about this time.
711. Philippicus puts Justinian to death.
713. The Saracens conquer Spain. The Bulgarians ravage Thrace.
714. Charles Martel governs all France.
717. The Saracens unsuccessfully besiege Constantinople. Charles Martel defeats king Chilperic.
718. Pelagio founds the kingdom of Asturias.
719. Boniface propagates Christianity in Germany.
726. Two edicts for demolishing images in churches.
727. Ina, king of Wessex, began the tax of Peter's pence.
729. Two comets appear this year, one before sun-rise, the other after sun-set.
730. The emperor excommunicated by Pope Gregory.
732. The Saracens defeated near Tours by Ch. Martel.
735. Charles Martel occupies Aquitaine.
736. Leo destroys the images throughout his empire, and persecutes the monks.
737. Joannes Damascenus, ob. 760.
740. The duchy of Spoletto seized by the Lombards. Leo III. dies, June 18. An earthquake at Constantinople, &c.
743. Fredegaire, the French historian.
744. The monastery of Fulda in Germany founded.
746. A pestilence in Europe and Asia for three years.
748. The computation of years from the birth of Christ begins to be used in histories from this time.
749. The race of Abbas become caliphs of the Saracens, and encourage learning. Many cities in Syria destroyed by an earthquake.
750. The Merovingian race ends in France.
751. The second race of the French kings begins.
752. The Exarchs of Ravenna conquered by the Lombards.
753. War between the Lombards and the pope.
754. Pepin aids the pope with a numerous army. The kingdom of Cordova, in Spain, founded.
755. The temporal dominion of the pope commences.
757. The first organ sent by Constantine to France.
761. A comet appeared at Rome, and moved from east to west.
762. Bagdad built by Almansor. The dead first buried in towns.
763. A violent frost begins Oct. 1, and continues about 150 days.
766. Armenia and Asia ravaged by the Turks.
770. Constantine dissolves the Eastern monasteries.
772. Charlemagne wages war against the Saxons.
774. The kingdom of the Lombards terminates.
775. Alcuinus flourished, ob. 804.
776. Nicephorus banished to the Chersonesus, in consequence of a conspiracy against Leo IV. The Saxons reduced by Charlemagne.
778. Battle of Ronçevaux. Learning restored in France by Charlemagne.

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781. Paulus Warnefridus, sirnamed Diaconus, the historian, ob. 801.
784. Charlemagne defeats Wittikind and the Saxons.
787. The Danes arrive in England. The seventh general council, or second of Nice, begins Sept. 24.
788. Pleadings in courts of judicature are instituted.
790. An earthquake at Constantinople.
791. The Avari defeated in Pannonia by Charlemagne. The Spaniards defeat the Moors with great slaughter.
792. An academy founded in Paris. Ethelbert murdered by Offa. Georgius the chronologer.
794. Charlemagne extirpates the Huns.
796. The pope sends legates to Charlemagne, to request him to confirm his election.
797. Seventeen days of unusual darkness. The Moors defeated by Alphonso. Constantine dethroned and his eyes put out by his mother Irené.
799. Majorca and Minorca taken by Constantine.
800. The temporal power of the popes abridged. Charlemagne proclaimed emperor of the West.

Ninth Century.

801. A great earthquake in France, Germany, and Italy.
802. Irené banished to Lesbos, Oct. 31. Joannes Damascenus, about ob. 846.
807. A large spot was seen on the sun for eight days, March 17.
808. The Normans make their first descent into France.
810. A civil war between Almamon and Alaminus.
811. Nicephorus killed by Crannus, king of the Bulgarians. Eginhard, the historian, ob. 842, July 6th.
814. Leo orders images to be demolished.
815. An insurrection in Rome against the pope.
816. Learning encouraged by Almamon.
817. Ecclesiastics exempted from military service. Lewis divides his kingdom among his children.
819. A degree of latitude on the plains of Sinjar measured by order of Almamon.
820. Leo V. killed in the temple at Constantinople.
822. Constantinople besieged by the Saracens; but the Bulgarians raise the siege.
823. The Saracens of Spain take possession of Crete, and call it Candia.
826. Harold, king of Denmark, embraces the Christian religion, and is dethroned by his subjects.
827. The Saracens obtain possession of Sicily, Calabria, &c. Bernard, count of Barcelona.
828. The several kingdoms of England united under Egbert. The kingdoms of Navarre and Arragon founded. Rabanus Maurus, ob. 856.
829. Missionaries sent from France to Sweden. St Mark's at Venice built.
832. Painters banished from the eastern empire by Theophilus, on account of his hatred of images.
837. A comet appears in China and in Europe. See Astronomy, p. 814.
838. Kenneth defeats and extirpates the Picts. A comet appeared in Scorpion on the 31st January in the evening.
839. A comet appeared in the Ram.
840. Lewis le Debonnaire dies, æt. 64. A comet appeared.
841. Lotharius defeated at the battle of Fontenai. Albumasar, the Arabian astronomer.
841. Theophilus dies. Germany separated from the em-

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pire of the Franks. In 841 or 842, a comet appeared in Aquarius.
843. A partition of the French dominions among the three brothers. Godescalchus, the heretic, ob. 870.
844. The king of Corduba defeated by the king of Spain. A comet appeared above Venus. The Vandals defeated by the king of Germany.
845. Irruption of the Normans into Germany. Hincmarus, archbishop of Rheims, ob. 882.
846. Rome besieged by the Saracens.
847. A great earthquake in Italy.
848. The Saracens defeat the Venetian fleet in Crotona Bay.
849. The pope's allies defeat the Saracen fleet.
850. Christianity propagated by Anscharius, in Denmark and Sweden.
851. England invaded by the Normans. The Spaniards defeated by the Moors. Sardinia and Corsica ravaged by the Saracens.
852. The English defeat the Danes at Okley. The Christians in Spain persecuted by the Moors.
853. The Normans obtain possession of some cities in France.
855. Lotharius retires to a monastery, and dies.
856. Coasts of Holland plundered by the Normans. An earthquake over a great part of the world.
857. The Britons defeat the Scots.
859. Carriages used on the Adriatic during an intense frost. Photius deposed in 886.
860. The schism of the Greeks begins.
861. Ruric, the first Russian prince, begins his reign.
862. Christianity propagated among the Sclavonians.
865. Civil war in the East among the Saracens. Italy ravaged by the Saracens.
866. Anastasius the librarian, ob. about 886.
867. The Danes conquer Northumberland. Christianity propagated in Bulgaria.
868. Egypt throws off its dependence on the caliphs of Bagdad under Ahmed. A large comet appeared.
870. England ravaged by the Danes.
872. Clocks brought to Constantinople from Venice. Alfred defeated by the Danes near Wilton. Charlemagne wages war against the Saxons.
873. France desolated by locusts and pestilence.
874. Scotland invaded by the Danes. In 874 or 876 a large red comet appeared.
875. A bearded comet appeared in France.
878. Alfred hides himself in the isle of Athelney ; but soon after drives the Danes from England.
879. Germany invaded by the Normans. Alfraganus the Arabian astronomer.
880. France ravaged by the Normans. Sept. 19th, A. M. $11^h\ 45'$ Albategni observes the obliquity of the ecliptic to be 23° 35′. Lewis and Carloman divide the French monarchy.
881. The Normans defeated in a great battle by Lewis.
882. A comet appeared on the 13th Feb. Albategni Aractus observes the aut. equinox at Aractus, Sept. 19th, $1^h\ 16'$ after midnight, ob. about 888.
884. Reginon the historian, ob. 908.
885. Paris besieged by the Normans.
886. University of Oxford founded by Alfred. The Scythians seize Croatia. Charles makes a disgraceful peace with the Normans.
888. Dominions of Charles le Gros divided into five kingdoms.
889. Greece ravaged by the Bulgarians.
890. France and the Low Countries ravaged by the Normans. Alfred divides England into counties, and completes his code of laws.
891. England again invaded by the Danes. The first land-tax in England. A comet appeared in China.
895. The monastery of Cluny is founded.
896. Rome taken by Arnolph of Germany.
897. War between the Greeks and Bulgarians. A great famine in Germany. John Asser, the historian, ob. 909.
899. Lombardy ravaged by the Hungarians. A comet appeared in 898 or 899.
900. Arnolph dies, and is succeeded by his son Louis III.

TENTH CENTURY.

901. Civil wars in France and Germany.
902. Himerius defeats the Saracens, and disperses their fleet. A comet appeared with its tail to the east, and continued visible for 40 days.
903. France ravaged by the Normans.
904. The Hungarians ravage Italy. A frost of 120 days begins at the end of the year.
905. Haron killed by Mahomet, the Saracen general. A remarkable comet appeared in China.
906. A very red comet appeared, and continued visible for half a year.
908. The dynasty of the Fatimites begins in Africa.
910. War in England with the Danes, lasts 12 years.
911. Leo VI. dies, June 11.
912. The Normans established in France. The Carlovingian emperors end in Louis III.
913. The crown of England seized by the Danes. A meteor with globes of fire appeared.
914. The Hungarians defeated by Conrad. The Saracens defeated by Constantine's generals.
915. Saxony ravaged by the Hungarians. University of Cambridge founded.
916. The Saracens in Spain defeated by Ordonno II. who kills 70,000.
917. Constantinople besieged by the Bulgarians.
919. Phocas killed by Romanus, who is raised to the empire.
920. The Christians defeated by the Moors in Spain.
922. The Hungarians pillage Germany. Berenger defeated by Rodolph at Placentia.
923. The Moors defeated in Spain. A comet appeared in China.
924. Italy ravaged by the Hungarians.
929. Eudes de Cluni, ob. 942.
930. A comet appears in Cancer.
932. Arnolph of Bavaria defeated near Verona by Hugh, king of Italy.
933. The Hungarians defeated in Germany. A frost of 120 days begins at the close of the year.
936. The Saracen empire partitioned into seven kingdoms.
937. Luitprand, the historian, ob. 970.
939. The Saracens defeated at Simanca by Ramirus king of Spain.
941. Arithmetic brought into Europe.
942. Naples seized by the eastern emperors. In 941 or 942, a comet appeared during 15 days of November.
944. A large globe of fire appeared.
945. France invaded by the Danes.
946. Edmund, king of England, assassinated at a feast given to his nobles.
947. Alfarabius, the Arabian astronomer.
950. Bohemia made tributary to Otho.
951. Berenger driven out of Italy by Otho.

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953. Otho subdues the Hungarians in Bavaria.
957. The Sclavonians defeated in Saxony by Otho.
958. War between the Normans and Saracens in Italy.
959. Italy pillaged by Berenger. The power of the monks very great in England. Rhazes, the Arabian physician, ob. 1010, æt. about 90.
960. Otho marches against the Vandals.
961. Candia recovered from the Saracens by Phocas.
962. A large comet appeared.
964. Italy united to the empire of Germany.
965. Geber the Arabian astronomer flourished.
966. Bulgaria invaded by Russia.
967. Cyprus and Antioch recovered from the Saracens by Nicephorus. Placed by some in 965.
968. A famine in Germany. Spain ravaged by the Normans.
969. Otho, jun. drives the Saracens from Italy.
971. The Russians, Bulgarians, &c. defeated by Bardas.
975. A comet appeared in August, and continued visible eight months.
976. Bardas usurps the eastern empire for 10 years.
977. The Bohemians subdued by Otho.
978. Abbo, the monk and astronomer, ob. 1003.
979. War between Otho and Lothaire. A comet appears in Virgo.
980. Apulia and Calabria recovered by Basil and Constantine, the emperors of Constantinople.
982. Albiranius, the Arabian geographer. Saxony ravaged by the Vandals and Bohemians. A civil war in Spain.
983. Venice distracted by violent commotions.
985. England and Scotland invaded by the Danes under Sueno.
986. An earthquake in Greece.
987. The Carlovingian race terminates, and the third race of kings begins in France.
988. Plague in Germany.
990. The Normans invade England.
991. The figures in Arithmetic brought into Europe, by the Saracens, from Arabia. Gerbert, afterwards Pope Silvester II. ob. about 1003.
993. A great eruption of Vesuvius.
994. England invaded with a great army by the King of Denmark.
995. Almanzor defeats the Christians.
996. Otho III. declares the empire of Germany elective. Hugh Capet dies, and is succeeded by his son Robert.
998. Almansor defeated by the Christians.
1000. Basil routs the Bulgarians, and drives them from Thessaly. In 999 or 1000 a large globe of fire appeared.

ELEVENTH CENTURY.

1001. An insurrection against Otho in Rome.
1002. Otho III. dies at Paterno. The title of king of the Romans assumed by the emperor Henry. Massacre of the Danes in England, Nov. 13. Avicenna, the Arabian physician, ob. 1050, æt. 80.
1004. England invaded by Sueno. A comet appears.
1005. The old churches begin to be rebuilt in a new style of architecture. A comet seen for 13 days.
1006. A pestilence throughout Europe for three years.
1007. A great eruption of Vesuvius.
1009. A civil war among the Saracens in Spain. A large comet appears at the end of May, and is seen during four months.
1110. An earthquake at Constantinople.

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1012. An annual tribute granted to the Danes by Ethelred.
1013. Sueno obtains possession of England.
1014. A violent storm, Sept. 18th, which inundated Flanders.
1015. The emperor of Germany receives an annual tribute from the king of Poland.
1016. Edmund Ironside fought six battles in England, with Canute II. of Denmark.
1017. A large comet appears in Leo.
1018. The Normans first penetrate into Italy in a body.
1019. Bulgaria reduced to a Roman province.
1020. A dreadful pestilence in Saxony.
1022. A new species of music, under six notes, introduced by Guy d'Arezzo or Aretino, the monk. See ARETINO.
1023. Palestine ravaged by the caliph of Egypt, who plunders the temple of Jerusalem.
1028. Norway conquered by Canute. Constantine, emperor of the East, dies æt. 70, and is succeeded by Romanus.
1030. Romanus defeated by the Saracens. Campanus of Novarro, the astronomer.
1031. The Saracens driven out of Syria by Romanus, who begins to build the temple at Jerusalem. Apulia conquered by the Normans.
1032. The kingdom of Arles bequeathed to Conrad.
1033. A great eclipse of the sun observed, June 29. Glaber, the historian, ob. after 1045.
1035. The king of Sicily takes Capua from the pope. Commencement of the kingdoms of Castile and Arragon. Saxony ravaged by the Vandals.
1036. The kingdom of Norway begins.
1038. Famine and earthquake at Constantinople. The dynasty of Omniades ends in Spain.
1040. Smyrna destroyed by an earthquake. Italy invaded by the Saracens of Africa. Bohemia ravaged by the Greeks.
1041. Hermanus, the monk and mathematician.
1042. A comet appeared Oct. 6. moving from east to west.
1043. The Russians from Scythia land in Thrace. The Turks obtain possession of Persia.
1046. Three usurping popes deposed by the council of Sutrium. Henry defeats William of Normandy in three battles. Franco the mathematician flourished.
1050. The Greek church separates from the Latin.
1052. Peter Damiani, ob. 1072.
1053. Pope Leo IX. taken prisoner by the Normans. Michael Cerularius, ob. 1058.
1055. Bagdad taken by the Turks, who overturn the empire of the Caliphs.
1057. Michael deposed by Isaac Comnenus, who is proclaimed emperor of Constantinople. Geo. Cedrenus, the historian.
1058. Saracens driven from Sicily by Robert Guiscard.
1059. Berenger, ob. 1088, æt. 90.
1060. A great famine in Germany.
1061. Sirnames appointed to be assumed in Scotland, by a parliament held at Forfar.
1062. A journey to Palestine undertaken by above 70,000 persons, who were either killed or made prisoners. Michael Psellus, the philosopher.
1063. The massacre of Goslar.
1064. A comet appeared during several months:
1065. The Turks take Jerusalem from the Saracens.
1066. A comet appeared in May, and followed the sun. It continued visible 40 days. The conquest of

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England by William the Bastard, duke of Normandy, in the battle of Hastings, Oct. 14.

1069. The Danes land in England, Sept. 11.

1070. The feudal law introduced into England.

1071. The Turks under Azun defeat Romanus, and take him prisoner. A comet appeared for 25 days, and moved from south to east.

1072. Sicily taken possession of by Roger. Sirnames used in England about this time.

1073. Marianus Scotus, ob. 1086.

1074. The king of Bohemia obliged to pay a tribute to the Holy See.

1075. Henry IV. defeats the Saxons at Neustadt, in Thuringia, June 9.

1076. Quarrel between Henry IV. and the pope. An earthquake in England. Asia Minor subdued by Solyman in 1074, now called Turkey.

1077. The emperor goes barefooted to the pope.

1079. Persian year reformed. Avicenna observes the vernal equinox, March 14, P. M. 2^h 9′. Arzachel, the Spanish astronomer.

1080. Domesday-book begins to be compiled, and was completed in 1086.

1081. Rome besieged by Henry. William of Spires, the mathematician.

1083. Rome taken by Henry, June 2.

1085. Toledo wrested from the Saracens.

1086. Bruno founds the order of Carthusians.

1087. An expedition of the Christians against the Saracens in Africa. France ravaged by William the Conqueror. Suidas, author of the Greek Lexicon.

1088. Alphonso VI. wrests the northern part of Portugal from the Saracens.

1089. Rosalinus of Compiegne, the head of the sect of Nominalists.

1090. The dynasty of Assassins begins in Irak, and continues 117 years.

1091. Joseph, king of Morocco, obtains possession of the dominions of the Saracens in that kingdom.

1092. Peter, sirnamed the Hermit.

1093. Conrad rebels against the Emperor Henry, his father.

1094. Sweden conquered by Margaret, and annexed to Denmark.

1095. Sigebert, the historian, ob. 1113.

1096. The first crusade into Palestine. A comet appeared. Naples and Sicily taken by the emperor.

1097. Nicæa taken by Godfrey of Boulogne. The Saracens defeated by the Christians. A comet appeared during the first eight days of October.

1098. Antioch taken by Godfrey. Order of St Benedict instituted.

1099. Jerusalem taken by the crusaders, July 15. Godfrey elected king of Jerusalem. Knights of St John instituted. Godfrey gains the battle of Ascalon.

1100. An earthquake in Sicily. William Rufus dies.

Twelfth Century.

1101. A comet appeared in February.

1102. The Saracens defeated near Joppa by Baldwin. William, duke of Aquitaine, goes to Palestine with a great army. A comet appeared during the fifteen last days of October.

1103. Massacre of William's army at Constantinople.

1104. Baldwin defeats the Saracens, and takes Ptolemais.

1105. Normandy invaded by Henry, king of England.

1106. A large comet appeared.

1107. A comet appeared for forty days.

1108. Hungary rescued from German servitude.

1109. Joseph, king of Morocco, defeats the Spaniards in the battle of the seven counts near Badajos. Tripoli taken by the crusaders.

1110. Learning revived at Cambridge. Paper made of cotton commonly used for writing. A comet appeared from June 6th till December, with its tail turned to the south.

1111. A comet appeared for a long time.

1113. War between France and England begins.

1114. Peter Abelard, ob. 1143, æt. 63.

1115. A large comet appeared.

1117. An earthquake in Lombardy. Anna Comnena, the historian.

1118. The order of Knights Templars instituted.

1119. Turks defeated at Antioch by Baldwin. Bohemia formed into a kingdom.

1120. Prince William, with a number of English lords, drowned in the English channel.

1121. The order of Premontre instituted.

1122. The Scythians defeated by John Comnenus.

1125. The Saracens overcome by Baldwin near Antioch. Germany afflicted with the plague.

1127. The pope makes war upon Roger, duke of Sicily, who is proclaimed king in the year 1130.

1130. Athelard, monk of Bath, the mathematician.

1132. The Cistertian monks exempted from tythes. St Bernard, ob. 1153.

1135. Beneventum, Capua, &c. taken by Roger, king of Sicily, from the pope. A comet appears on the 8th October.

1136. Averroes of Corduba, ob. 1206.

1137. The pandect of Justinian found in Amalfi.

1138. England invaded by the Scots, who are defeated. A comet appears in China.

1139. A civil war in England. Alphonso, after defeating five Saracen kings, and taking Lisbon, is proclaimed king of Portugal.

1140. King Stephen taken prisoner at Lincoln, Feb. 2. The doctrine of Abelard condemned. The canon law brought into England. William of Malmesbury, the historian.

1141. Stephen begins to recover his kingdom. The dissensions between the Guelphs and Gibelines prevail. Peter Lombard, ob. 1164.

1143. The Alkoran translated into Latin.

1144. The primacy of the church of Toledo confirmed.

1146. The dynasty of the Almoravides in Africa and Spain succeeded by that of the Almohedes. The Empress Matilda leaves England.

1147. The second crusade into the Holy Land by the preaching of St Bernard.

1148. Damascus unsuccessfully besieged by the Christians. Conrad and Louis arrive at Jerusalem. Humenus, the Egyptian astronomer.

1149. Henry of Anjou asserts his claim to the crown of England. Greece ravaged by Roger VI. of Sicily.

1150. The civil law revived at Bologna by Wernerus, who died in 1190.

1151. The canon law composed by Gratian.

1152. Geoffrey of Monmouth.

1153. Treaty of Winchester, by which Stephen grants to Henry the reversion of his kingdom.

1154. Damascus taken by Nouradin. Christianity introduced into Finland. Al Edrisius, the Arabian geographer.

A. D.

1156. The city of Moscow founded.

1157. An earthquake in Spain. Nouradin defeated near Gennesareth by Baldwin. Finland conquered by the Swedes.

1158. Frederic received the title of king of Bohemia at the diet of Ratisbon.

1159. Commotions in Scotland. War between England and France. The pope excommunicates the emperor. John Tzetzes, the critic and historian, ob. about 1176.

1160. The order of Carmelites instituted.

1161. Eustathius, the commentator on Homer.

1162. The power of the Crusaders declines in Palestine. The emperor Frederic destroys Milan, but preserves the churches.

1163. Raymond II. defeated by Nouradin. John of Salisbury, ob. 1187.

1164. The first king of Sardinia created by Frederic. A contest between Henry of England and Becket. The council of Clarendon, Jan. 25.

1165. Two comets, or one comet with two tails, appear in Libra.

1166. Maimonides of Corduba, a learned Jew, ob. 1208.

1167. Rome taken possession of by Frederic. War between England and France. Egypt invaded by the caliph of Persia. Henry of Huntingdon.

1169. An interview at St Denis between the kings of England and France.

1170. Peace concluded between France and England. An earthquake at Antioch.

1171. The island of Chio taken by the Venetians. The dynasty of Fatimites ends in Egypt.

1172. Henry II. of England takes possession of Ireland.

1173. Catania destroyed by an earthquake.

1174. William acknowledges the kingdom of Scotland a fief of the crown of England.

1176. Frederic defeated by the Milanese. Circuits established in England. Zenghis-kan begins to reign.

1177. Saladin defeated by Baldwin before Jerusalem.

1178. A legate sent by the pope to Prester-John.

1179. Saladin defeats the crusaders. Becket's tomb in England visited by the French king. The university of Padua founded.

1180. Glass commonly used in England.

1181. The laws of England digested by Glanville.

1182. Damascus taken by Saladin.

1183. The inhabitants of Berry massacre 7000 Albigenses. Peter of Blois, the historian, ob. 1200.

1184. Andronicus murders the Latins in Constantinople.

1186. The Roman yoke thrown off by the Bulgarians. A conjunction of all the planets happened on Sept. 16th, at sunrise, sun in ♍ 30° Jupiter, in ♎ 2° 3′, Venus in 3° 49, Saturn in 8° 6′, Mercury in 4° 10′, Mars in 9° 8′, tail of the Dragon 18° 23′ ♎.

1187. The kingdom of Jerusalem finished by the capture of that city by Saladin, Oct. 2d.

1188. The third crusade fixed at the diet of Mayence. The Saracens routed by the Dutch and Zealanders. Mecklenburg held as a fief of the crown of Denmark.

1189. The kings of England and France go to the Holy Land. Richard renounces his superiority over Scotland.

1190. Cilicia subdued by Frederic, who defeats the Saracens. The Teutonic order of knights instituted at Ptolemais. Others place it in 1164.

1191. Ptolemais taken by the Crusaders.

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1192. Richard, king of England, made prisoner by the emperor Henry VI. Saladin defeated by Richard in the battle of Ascalon. Roger de Hoveden, the historian.

1195. Spain invaded by the Saracens from Africa, who defeat Alphonso, and kill 50,000 Spaniards.

1196. Naples and Sicily taken possession of by the emperor Henry VI.

1197. Henry sends an army into Palestine. William of Newburgh the historian.

1198. The order of the Holy Trinity instituted.

1199. Peace between England and France. Campanus, of Lombardy, the astronomer.

1200. University of Salamanca founded by Alphonso IX. William, king of Scotland, does homage at Lincoln to the king of England, Nov. 21. A very large comet appeared. It moved over 2 signs in 18 days.

THIRTEENTH CENTURY.

1201. City of Riga founded. War between England and France.

1202. Gervase of Canterbury, the historian.

1203. The 3d crusade under Boniface sets out from Venice, and reaches Chalcedon 24th June.

1204. The Venetians and French take Constantinople. Normandy reunited to France. The Inquisition established.

1205. The Bulgarians defeat Baldwin near Adrianople.

1207. Rouen and Falaise erected into corporations.

1208. The order of Fratres minores established. The Pope excommunicates King John of England.

1209. The works of Aristotle imported in 1209 from Constantinople, are condemned by the council of Paris in 1210. The silk manufacture imported into Venice by Greek weavers. Ralph de Diceto, the historian.

1210. The Albigenses violently persecuted. The Pope excommunicates the emperor Otho.

1211. Wales subdued by the king of England. Saxo-Grammaticus, the historian.

1212. The Moors signally defeated by the Christians at Thoulouse, July 12.

1213. The king of England becomes the pope's vassal. Walter of Coventry.

1214. War between the English and Scotch. Otho routed by Philip near Bouvines. The Persians defeated by the Turks. A comet appeared in March.

1215. The order of Dominicans instituted. A comet appeared in March. The order of Knights-Hopitallers founded. Magna Charta signed by King John, June 15th.

1216. Scotland excommunicated by the pope's nuncio. Peter de Courtenay imprisoned. Accorso, ob. 1229.

1217. Peace between the English and Scotch. The French defeated in the battle of Lincoln. A comet in autumn near the Crown.

1219. Damietta taken from the Saracens by the Christians.

1220. Astronomy and geography brought into Europe by the Moors.

1221. The university of Padua enlarged. St Anthony of Padua, ob. 1231.

1222. A great earthquake in Germany. Damietta evacuated by the Christians.

1223. The slaves in France franchised by Louis VIII. An extraordinary comet appeared in Denmark.

A. D.

1223. A comet appeared in the East. John de Sacrobosco, a mathematician of Halifax, in Yorkshire, ob. at Paris 1244.

1226. The king of France, &c. leagues against the Albigenses.

1227. A general expedition from the different states of Europe to Palestine. The Tartars, under Zenghis-kan, over-run the empire of the Saracens.

1228. University of Thoulouse founded.

1229. A treaty between the Christians and Saracens. A conspiracy in Sweden. Alexander Halensis, ob. 1245.

1230. Denmark desolated by the plague. The Teutonic knights subdue Prussia. Several persons murdered in the university of Paris, in consequence of the disputes about Aristotle. A comet appeared. See Astronomy, p. 814.

1231. The Almagest of Ptolemy translated into Latin.

1232. William, bishop of Paris, ob. 1248.

1233. The Dominicans entrusted with the Inquisition. Order of the Knights of the Blessed Virgin instituted.

1234. Peter de Vignes, chancellor to Fred. II. ob. 1249.

1236. The Tartars first penetrate into Russia, Poland, &c.

1238. University of Vienna founded. The Tartars exact a tribute from the Russians. A comet which moved with great velocity.

1239. The Guelphs and Giblines continue to desolate Italy.

1240. The king of Denmark published a code of ancient Cimbrian laws. Poland and Hungary invaded by the Tartars. A large comet appeared east of the Pole.

1241. The Swedes and Livonians defeated by the Russians near Narva. The Hanseatic league formed. Tin mines discovered in Germany. A comet in January, seen 30 days. Matthew Paris, the historian, ob. 1259.

1242. A plague in France, Italy, and Greece. Grostest, bishop of Lincoln, ob. 1254.

1244. Jerusalem taken by the Kharismians, who defeat the Christians. The order of the Celestines instituted.

1245. The general council of Lyons for renewing the crusades. A large comet appeared.

1248. The 5th crusade under Lewis IX.

1249. Damietta taken by Lewis IX. June 5.

1250. Lewis taken prisoner in Egypt. Cimabue revives painting in Florence, ob. 1300. The Sorbonne founded in Paris.

1251. Wales subdued, and Magna-Charta confirmed.

1252. Alphonso of Spain found the sun's apogee in ♊ 28° 40′. Albertus Magnus, ob. 1280, æt. 75.

1253. The Alphonsine tables published. Linen first made in England.

1254. War between Denmark and Sweden. A comet, seen for several months. St Thomas Aquinas, ob. 1274.

1255. A large comet appeared.

1256. The order of the Augustines established.

1257. St Bonaventura, ob. 1274, æt. 53.

1258. The capture of Bagdad by the Tartars terminates the empire of the Saracens. Treaty of Barcelona. Representatives of the commons of England present for the first time in parliament. Blair places this in 1264. John de Joinville.

1259. Treaty of Abbeville. The Tartars invade Poland. Nassar Eddin, the Persian astronomer and geographer.

1260. Alphonso of Spain orders all public records to be written in the vulgar tongue, not in Latin, and publishes the code of laws called *Las Partidas.*

1261. Constantinople recovered from the French by the Greek emperors. Roger Bacon, ob. 1284, æt. 78.

1263. The Hebrides invaded by the Norwegians. Civil wars in England.

1264. Henry taken prisoner at the battle of Lewes. The deputies of towns and boroughs summoned to parliament. (Playfair.) A comet with a long tail appeared. See Astronomy, p. 814.

1265. The battle of Evesham in England, Aug. 4.

1266. The battle of Benevento, where Mainfroi is killed, Feb. 26. Peace between Norway and Scotland.

1267. Police established at Paris about this time.

1268. Antioch taken by the Mussulmans. Conradin taken at the battle of Celano, in Italy, and afterwards beheaded, Aug. 29th. The Tartars invade China.

1269. Cozah Nasirodni observed the obliquity of the ecliptic to be 23° 30′.

1270. Louis IX. embarks at Aigues-Mortes for Palestine. Bulgaria reduced by the king of Hungary. The Scots guard embodied in France.

1272. The academy of Florence founded. The orders of Mendicants reduced to the Dominicans, Franciscans, Carmelites, and Hermits of St Augustin.

1273. The empire of Austria begins. Cheouching, in China, observed the obliquity of the ecliptic to be 23° 33′ 39″.

1274. First treaty of commerce between England and Flanders.

1275. Durandus, ob. 1296.

1277. The sultan of Egypt defeats the Tartars near Damascus.

1279. Edward relinquishes his claim upon Normandy. The mortmain act passed in England. Henry of Ghent, ob. 1293, æt. 76.

1280. The Tartars defeated near Emessa by the sultan of Egypt.

1281. Marienburg built by the Teutonic Knights.

1282. Ten thousand French massacred at the Sicilian vespers, March 20. A great plague in Denmark. The academy of del la Crusca founded.

1283. Wales subjugated, and united to England. A new separation between the Latin and Greek churches. Raymond Lully, ob. 1315, æt. 80.

1285. Hungary ravaged by the Tartars. Alphonso of Arragon deprives his uncle of Majorca. Jacobus de Voragine, ob. 1298.

1286. Eric V. king of Denmark, assassinated near Vibourg. A comet appeared with its tail to the east.

1287. A clock at Westminster about this time. The Tartars penetrate into Poland.

1288. Tripoli taken by the sultan of Babylon.

1289. A great earthquake in Europe. Albert the mathematician and Provençal poet.

1290. The Jews banished from England. University of Lisbon founded.

1291. Syria conquered by the sultan of Babylon. Competition between Bruce and Baliol for the crown of Scotland. The Turks take Ptolemais by assault. The crusades terminate. John Duns, called Scotus, ob. 1308, æt. 43.

1293. From this year there is a regular succession of parliaments in England. A comet appeared in summer.

1294. Parliaments established in Paris.

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1296. A war between the English and Scotch. An intense frost in Denmark.

1297. Edward carries off the coronation chair, and records of Scotland.

1298. The Ottoman empire founded. A large comet appeared.

1299. An earthquake in Germany. A comet appeared; see ASTRONOMY, p. 814. A monk of Pisa invents spectacles. Boniface VIII. institutes the year of jubilee at Rome. Faenza earthen ware invented.

1300. The Ottoman empire begins. Scotland invaded by Edward.

FOURTEENTH CENTURY.

1301. Philip excommunicated by the pope. A comet appeared; see ASTRONOMY, p. 814. Peter de Abano, ob. 1316, æt. 66.

1302. The Tartars defeated near Damascus by the sultan of Egypt. The mariners' compass invented (or improved) by Flavio. University of Avignon founded.

1303. Three English armies defeated by the Scots in one day, near Roslin.

1304. A comet visible for three months to the north. Dante, ob. 1321, æt. 56.

1306. The Jews banished from France. Edward invades Scotland, which is defended by Bruce. Arnoldus de Villa Nova, ob. 1340.

1307. Coals first used in England. The Swiss cantons established.

1308. University of Lisbon removed to Coimbra. The seat of the popes removed to Avignon for 70 years.

1310. Rhodes taken by the knights of St John, who settle there.

1312. The council of Vienna abolishes the order of knights Templars. University of Orleans founded. A comet appeared. Durandus, ob. 1333.

1313. Molay, the grand master of the Templars, burned alive at Paris, along with several of the knights.

1314. The cardinals set fire to the conclave, and separate. The battle of Bannockburn, in which the English are completely beaten by the Scots, July 25.

1315. Germany afflicted with famine and pestilence. The Scots invade Ireland. A comet appeared in December, near the north pole.

1316. A comet appeared in February. This comet is not mentioned either by Lubiniezki or Hevelius.

1317. Nicholas de Lyra, ob. 1340.

1318. A comet appeared in Cancer. A great famine in Britain.

1319. University of Dublin founded. William Occam, ob. 1343.

1320. An earthquake in England. Gold coined in Europe.

1321. A civil war in England.

1322. The battle of Muldorf, at which Frederick III. was taken prisoner.

1323. A truce of 13 years between the English and Scotch. A great eruption of Ætna.

1325. The first commercial treaty between England and Venice.

1326. Queen Isabella brings an army into England against her husband Edward III.

1327. Edward II. deposed by the English parliament.

1329. Philip defeats the Flemings at the battle of Mount Cassel.

1330. Gun-powder invented by a monk of Cologne.

1331. The city of Nice taken and plundered by the Turks. The Teutonic knights settle in Prussia. The art of weaving cloth introduced into York by two Brabant weavers.

1332. Silesia seized upon by the king of Poland. The pope charged with heresy. Nicephoras Gregoras the astronomer and historian, ob. 1350.

1333. Gibraltar taken by the Moors. The Scots defeated near Berwick, July 19.

1337. Edward III. makes war with France. He sets sail with his army July 15. A comet appeared. See ASTRONOMY, p. 814.

1338. The empire of Germany declared independent of the pope. Edward makes war upon France.

1339. The academy of Pisa established. A comet appeared. Denmark desolated by war, pestilence, and famine.

1340. Edward III. defeats the French in a naval battle near Helvoetsluys, which leads to a peace of 4 years. Copper money first used in Scotland and Ireland.

1341. The eastern empire usurped by Cantacuzenus for 17 years. A comet appeared in ♎ in the spring. It was first seen near Spica Virginis, moved through 5 degrees every day, and disappeared near ♌.

1342. Powder used at the siege of Algiers. Edward's expedition to the Continent. The knights and burgesses first assembled together in the same house of the English parliament.

1343. Leontius Pilatus of Thessalonica, restorer of Greek literature in Italy, flourished.

1344. Macham, an Englishman, discovers the Madeira islands. Gold coined in England. Poland invaded by the Tartars.

1346. The battle of Cressy, Aug. 26. The English defeat the Scots, and take David prisoner.

1347. A comet appeared in August, and was seen two months. The plague ravages Europe, and is said to carry off one-fourth of the inhabitants. The admiralty court instituted. Calais taken by Edward, Aug. 4. A code of laws published in Poland, and the university of Cracow founded. Rienzi's usurpation at Rome.

1348. The university of Prague founded.

1349. The order of the Garter instituted in England, April 23. A plague in England, Scotland, and Ireland, and other parts of Europe.

1350. The Jubilee fixed to every fiftieth year.

1351. Wire invented at Nuremberg.

1352. First irruption of the Turks into Europe.

1353. Africa and Asia desolated by locusts. A comet appeared, and moved from north to south.

1354. Francis Petrarch flourished, ob. 1374, æt. 76.

1355. A conspiracy at Venice. Boccacio, ob. 1376, æt. 62.

1356. Battle of Poitiers, at which the French are defeated, and King John taken prisoner, Sept. 19. An earthquake in Germany.

1357. Great commotion in France.

1358. Tamerlane commences his reign in Persia. Treaty of Calais signed, Oct. 24.

1359. Treaty of Bretagne, May 8.

1361. Matthew of Westminster, ob. about 1380.

1362. Law pleadings in England carried on in English instead of French. Military order of Janizaries established among the Turks. A comet appeared near Venus.

1364. Battle of Cocherel, May 6, and of Avrai, Sept. 29.

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1365. The universities of Geneva and of Vienna founded.

1366. Adrianople becomes the seat of the Turkish empire.

1367. The battle of Neiara in Spain, April 4.

1368. The battle of Montial, March 14.

1369. Wickliffe teaches the doctrine of the Reformation in England. ob. 1385.

1370. Chivalry flourished about this time.

1371. The English fleet defeated by the French near Rochelle, June 23.

1372. Earl of Pembroke defeated at sea by the Spanish admiral, June 23.

1373. Cyprus taken by the Genoese. John Gower the first English poet, ob. 1402.

1375. A peace of three years between France and England.

1376. John Froissart flourished, ob. 1400.

1377. England invaded by the French. The seat of the popes transferred from Avignon to Rome. Flanders inundated by the sea. Wickliffe's doctrine condemned in England.

1378. The schism of double popes, which lasts 38 years. Greenland discovered by a Venetian.

1379. Great dissensions in Flanders.

1381. Bills of exchange first used in England. Pestilence in Germany. Watt Tyler's insurrection in the beginning of July.

1382. The battle of Rosebeck in Flanders, Nov. 17. Hierapolis taken by the Turks.

1383. Cannon first used in the English service by the governor of Calais. Abulfeda, the Arabian geographer, died.

1384. Philip, Duke of Burgundy, succeeds to the earldom of Flanders. The first navigation act in England. War between the English and Scotch.

1385. Battle of Aljubaroba, at which the King of Castile is routed by the King of Portugal, August 14. Nicholas Flamel, ob. 1409.

1386. Constantinople taken by Andronicus Paleologus; retaken by John and Manuel. The first company of linen-weavers in England.

1387. Tamerlane subdues Georgia and Turkestan.

1388. Battle of Otterburn, at which the English are defeated by the Scotch, July 31. Margaret of Denmark defeats the Swedes at Falcoping, Sept. 21. Union of the Danish and Swedish crowns.

1390. The sacred war in Prussia.

1391. Cards invented for the amusement of the French king. The English parliament abolishes the papal power. Commotions in Scotland.

1392. Jews expelled from Germany. The Portuguese discover the Cape of Good Hope. Emanuel Chrysoloras, ob. 1413, æt. 60.

1393. The Turks ravage Wallachia, and defeats the Hungarians. The doctrines of the Reformation propagated in Bohemia by Huss and Jerome of Prague.

1394. The Jews expelled from France, Sept. 17. A comet appeared in the evening, and moved from west to north.

1395. The Christians, under Sigismund, defeated at Nicopolis by Bajazet, Sept. 28, who also subdues the Bulgarians.

1396. Geoffroy Chaucer, the English poet, ob. 1440.

1397. The union of Denmark, Sweden, and Norway, at Calmar. Owen Glendower, ob. about 1408.

1398. A rebellion in Ireland. Dukes created in Scotland. Tamerlane penetrates into Hindostan. Intense frost in Denmark.

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1399. Tamerlane takes Delhi, and afterwards takes Novogorod.

1400. War between the English and Scotch. Tamerlane, with a great army, enters Asia Minor. A large comet appears in February, moving towards the west.

FIFTEENTH CENTURY.

1401. Italy invaded by the emperor Rupert, who is repulsed. Tamerlane takes Bagdad, Aug. 9th. A very large comet appeared.

1402. Battle of Angoria, at which Bajazet is defeated by Tamerlane, and taken prisoner July 28th. Battle of Haledown hill, May 7th.

1403. The battle of Shrewsbury, at which Hotspur is slain, July 22d. A comet appeared in March with its tail towards the north.

1405. Conspiracy of Archbishop of York against Henry suppressed. Great guns first used at the siege of Berwick. Famine and the plague in Denmark. Canary islands discovered by Bethencourt.

1406. A comet appeared. Leonard Aretino, secretary of Florence, ob. 1443, æt. 74. Brunus of Arezzo, secretary of Florence.

1407. The kingdom of France laid under an interdict. A comet appeared. Balthazar Cossa obtains possession of Rome.

1408. A comet appeared.

1409. The council of Pisa commences March 25.

1410. Painting in oil colour invented by John Van-eyck at Bruges. A civil war in France.

1411. The university of St Andrews founded. War between the pope and king Laudislaus.

1412. Algebra introduced into Europe from Arabia.

1414. The council of Constance commences, Nov. 16th. A comet appeared.

1415. John Huss condemned and executed, July 6th. Normandy invaded by Henry of England. Battle of Agincourt, Oct. 25th, at which the French are routed by the English.

1416. The French fleet defeated by the English at the mouth of the Seine. Jerome of Prague dies.

1417. Henry's second expedition into Normandy. Paper made of linen rags invented. According to others, about 1100.

1418. The Armagnac faction massacred in Paris. Poggio, the Florentine, ob. 1459. æt. 80.

1420. The treaty of Troyes signed, May 21. Madeira discovered by the Portuguese.

1421. The Duke of Clarence is killed at the battle of Beaugé, April 3.

1422. The vulgar Christian æra introduced into Portugal.

1423. Engraving on metal, and rolling press printing, invented. Battle of Crevant, in which the French and Scots are defeated by the English.

1424. The English under the Duke of Bedford defeat the French in the battle of Verneuil, Aug. 16. Flavius Blondus, ob. 1463, æt. 75.

1426. An earthquake at Naples. A comet appeared.

1427. The academy of Louvain founded. Theodore Gaza, ob. 1478, æt. 90.

1428. The siege of Orleans begins, Oct. 12, and continued to May 12th.

1429. The battle of Herrings, Feb. 12th. Battle of Patay. Francis Philelphus, ob. 1481, æt. 83.

1431. A great earthquake at Lisbon. Henry, king of

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England, crowned king of France. Geo. Trapezuntius, ob. 1485, æt. 90.

1432. A comet appeared.

1433. A very large comet appeared for three months. G. Gemistius Pletho, ob. 1490, æt. 100.

1434. A civil war in Sweden. Cosmo de Medici recalled from exile. A comet appeared.

1435. The treaty of Arras between Charles II. and the duke of Burgudy. A comet appeared.

1436. Paris retaken by the French, April 13th. Laurentius Valla, ob. 1465, æt. 50.

1437. An expedition of the Portuguese into Africa. Hungary invaded by the Turks. Ulugh Beigh observed the obliquity of the ecliptic to be 23° 30′ 17″, ob. 1449, æt. 57.

1438. A shower of meteoric stones fell at Rou, near Burgos in Spain.

1439. The Greek and Latin churches united. The Pragmatic sanction settled in France. A comet appeared in the east, with its tail turned to the south.

1440. The art of printing invented at Mentz. John Guttemberg, ob. after 1460.

1441. Siege of Pontoise. John Faustus, ob. about 1466.

1442. The Turks invade Hungary. Peter Schæffer, ob. after 1479.

1444. Battle of Varnes gained by the Turks. Famine in Sweden. A comet appeared in Leo. Truce between France and England at Tours, June 1st. Wesselus, ob. 1489, æt. 70.

1445. A comet appeared.

1446. Inundation at Dort, April 17th, which drowns 100,000 persons. Frederick declares war against the Swiss.

1447. The Turks defeated by Scanderbeg in 22 battles, during several years.

1448. The house of Oldenburgh begins to reign in Denmark, in the person of Christiern I. The English defeated by the Scotch at Sark. The crowns of Sweden and Denmark disunited. Contests between the houses of York and Lancaster. The Vatican founded at Rome.

1449. War between England and France. Ulugh Beigh killed by his sons. G. Purbachius, ob. 1462, æt. 87.

1450. University of Glasgow founded by Bishop Turnbull. Delft ware invented at Florence. A very large comet appeared in summer, which eclipsed the moon, and moved from east to west. The battle of Fourmigni, April 18.

1451. The English evacuate Rouen. War between Denmark and Sweden. Æneas Sylvius Pius II. ob. 1464.

1452. Cardinal Bessarion, ob. 1472, æt. 77.

1453. The Turks take Constantinople, May 29th. The battle of Castillon terminates the English government in France, July 7.

1454. A conspiracy against the pope in Rome. The Prussians and Poles wage war for twelve years against the Teutonic knights. Thomas à Kempis, ob. 1471. Two comets appear.

1455. The battle of St Alban's, May 31st.

1456. A great earthquake at Naples. The Turks repulsed at the siege of Belgrade. A large comet appears; see Astronomy, p. 814.

1457. Glass first manufactured in England. A comet appears in June in the 20th degree of Pisces. Joannes Argyropulus, ob. 1480, æt. 70.

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1458. Corinth taken by the Turks. A sedition in England. A comet appears in July below Taurus.

1459. Alphonso's first expedition into Africa.

1460. Battle of Northampton, July 19th. A large comet appears. Battle of Wakefield Dec. 31. Alum mines discovered in Italy. Wood cuts invented.

1461. A comet appeared. King Edward defeats king Henry at Towton, March 29th. Regiomontanus, ob. 1476. æt. 60.

1462. An expedition of the Turks into Wallachia. The first book printed, viz. the Vulgate Bible in 2 vols. Baptista Platina, ob. 1481, æt. 60.

1463. A comet appears. The plague rages in Saxony and Thuringia. War between the Venetians and Turks. Alphonso's second expedition into Africa.

1464. League against Louis XI. of France. Rodolph Agricola, ob. 1485, æt. 43.

1466. The second printed book, viz. Cicero de Officiis.

1467. Sheep first sent to Spain from England. A comet appears above the Fishes.

1468. Two comets appear, one of which is seen 15 days in the north, and the other 15 days in the west. Warwick's conspiracy against Edward. Jos. Jovianus Pontanus, ob. 1503, æt. 70.

1469. Battle of Banbury, July 26th. Order of St Michael instituted in France.

1470. A comet appears on the 13th January. Battle of Stamford, March 14. King Edward attainted. King Henry VI. restored. Casts in plaster invented by Verochio.

1471. A comet appears in autumn. Battle of Barnet, April 14. Edward restored. The battle of Tewksbury, May 4th. Marsilius Ficinus, ob. 1499, æt. 56.

1472. War between the Turks and Parthians. A comet appeared; see Astronomy, p. 814. John Lascaris, ob. 1513, æt. 90.

1473. Tiphernas introduced into France the study of the Greek language. A comet appears in Cancer.

1474. The Portuguese discover the Cape de Verde islands. Annius of Viterbo, ob. 1492.

1475. Constable de St Paul beheaded. The treaty of Amiens, Aug. 29. Poland and Hungary infested with locusts. A comet appears in Libra.

1476. A comet appears in June. Ferdinand of Castile defeats the king of Portugal. George Merula, ob. 1494.

1477. Watches made at Nuremberg. Duke of Burgundy defeated and killed at Nancy. A comet appears in January.

1478. Laurence de Medici banished from Florence. Peace between France and Castile, Nov. 9. Waltherus observed the vernal equinox in March 11. 8^h 15′.

1479. University of Upsal founded. Union of the kingdoms of Castile and Arragon.

1480. Rhodes besieged by the Turks.

1481. A great famine in France. Savonarola, ob. 1498, æt. 46.

1482. The Portuguese discover the coast of Guinea. Jo. Picus, of Mirandola, ob. 1494, æt. 37.

1483. A conspiracy in England. Post horses and stages established.

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1484. Famine and the plague raged in Denmark.

1485. Battle of Bosworth, Aug. 22. The houses of York and Lancaster united. Demetrius Chalcondyles, ob. 1513.

1486. The Russians conquer the kingdom of Casan. Angelo Politian, ob. 1494, æt. 46.

1487. The star-chamber instituted in England. Hermolaus Barbarus, ob. 1493, æt. 39.

1488. The battle of St Aubin, June 28. Cape of Good Hope discovered.

1489. Maps and sea charts introduced into England. Diamonds polished at Bruges. An earthquake at Constantinople. Cyprus ceded to the Venetians.

1490. Poetry begins to flourish in Germany.

1491. A comet appears in Spring during an eclipse of the sun, towards the south. The study of the Greek tongue introduced into England, by William Grocyn, ob. 1522, æt. 80. Baptista Mantuanus, ob. 1516, æt. 68.

1492. A comet appears in December, and is visible in the evening for two months. Brittany re-united to France. America discovered by Columbus, placed by Blair in 1494. Isle of St Domingo discovered. Peace between Charles VIII. and Henry VI. Ferdinand expelled the Moors from Granada, after a possession of above 800 years. A meteoric stone, of 260 pounds weight, fell at Ensisheim, near Sturgau in Alsace, November 7.

1493. A comet seen before and after passing its meridian. Montserrat discovered. Jo. Reuchlin, surnamed Capnio, introduces the Hebrew and Greek languages into Germany, ob. 1521, æt. 67.

1494. University of Aberdeen (King's College) founded by Bishop Elphinstone. Poyning's act passes in Ireland.

1495. Kingdom of Naples seized by the king of France. Algebra taught by a Friar at Venice. The diet of Worms. The venereal disease brought into Europe.

1496. The Jews and Moors expelled from Portugal. John Colet, ob. 1519, æt. 53.

1497. Americus Vespucius discovers North America. Vasquez de Gama's expedition to the East Indies.

1498. Poland ravaged by the Wallachians, who carry off 100,000 prisoners, and sell them to the Turks. Alexander ab Alexandro, ob. 1521, æt. 50.

1499. A comet appears. War between the Venetians and the Turks. Louis XII. takes possession of the Milanese. Dr Thomas Lynacre, ob. 1524.

1500. A comet appears in April, and is seen below Capricorn for 18 days. The Portuguese discover Brasil. John Cabot discovers Florida. The empire divided into six circles by Maximilian. Painting in chiaro obscuro discovered. A great pestilence in England.

Sixteenth Century.

1501. Inquisitorial tribunal established at Venice. The kingdom of Naples seized by Louis of France and Ferdinand of Castile. Aldus Manutius, ob. 1513.

1502. St Helena discovered. Pomponatius of Mantua, ob. 1525, æt. 63. Gonsalvo, ob. 1515, æt. 72.

1503. The battle of Cerignole, April 28. Leonardo da Vinci, ob. 1520, æt. 75. Cardinal Ximenes, ob. 1517, æt. 80.

1504. A comet appears. King Henry VII. built a chapel at Westminster Abbey. Hats made at Paris. Gawin Douglas, ob. 1521.

1505. Shillings first coined in England. Two comets appeared. Albert Durer of Nuremberg, ob. 1528, æt. 57.

1506. A comet appears in August. Academy of Frankfort on the Oder founded. Ceylon discovered. Nicholas Machiavel, ob. 1529.

1507. The Genoese subdued by Louis. Madagascar discovered by the Portuguese. Lewis Ariosto, ob. 1533.

1508. The league of Cambray against the Venetians signed, Dec. 10. Budæus of Paris, ob. 1540, æt. 73.

1509. The Venetians defeated. The battle of Aignadel, May 14. An earthquake at Constantinople, Sept. 14.

1510. About 1200 meteoric stones, one of which weighed 120, and another 60 pounds, fell at Padua. The pope grants to Ferdinand the investiture of Naples, July 23.

1511. A large comet appears in Leo, in June and July. The Spaniards conquer the island of Cuba. A league against the French between the emperor, the pope, and the Venetians, Oct. 4. Raphael, ob. 1520, æt. 37.

1512. A comet appears in March and April. The battle of Ravenna, April 11. The river De la Plata discovered. Etching on copper invented. Some place it in 1459. Erasmus, ob. 1536, æt. 70.

1513. War between England and Scotland. The battle of Novarro, in which the Swiss defeat the French. Battle of the Spurs, Aug. 16. Battle of Flodden, between the Scotch and English, Sept. 9. Sannazarius of Naples, ob. 1530.

1514. A comet appears in Leo in Jan. and Feb. Cannon bullets of stone still used. War between the Ottoman empire and Persia. Polydore Virgil, ob. 1555, æt. 80.

1515. Copernicus observed the vernal equinox, March 11, 4^h 30′ morn. at Fruemberg. He observed Spica Virginis in ♎ 17° 3′ 2″, and the sun's apogee in ♋ 6° 40′. The 1st Polyglot Bible printed at Alcala. Battle of Marignan between the French and Swiss, Sept. 13 and 14. Ferdinand annexed the kingdom of Navarre to that of Castile. Cornelius Agrippa, ob. 1534, æt. 48.

1516. A comet appears. The kingdom of Algiers seized by Barbarossa. War between the Persians and Turks. Treaty of Noyon, Aug. 16. Francis Guiccardini, ob. 1540, æt. 58.

1517. A comet appears in Leo. Luther propagates the doctrines of the Reformation in Germany, ob. 1546, æt. 63. The Turks terminate the kingdom of the Mamelukes in Egypt.

1518. New Spain and the Straits of Magellan discovered. Zuinglius, ob. 1531.

1519. Francis I. and Charles V. claim the imperial throne. Proportional compasses invented before this by L. da Vinci. Cardinal Bembo of Venice, ob. 1547, æt. 68.

1520. A comet appears. War between Prussia and Po-

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land. Sweden and Denmark united. The confederacy of the Holy Junta in Spain. Ludovicus Vives of Valentia, ob. 1536.

1521. A large comet appears in April between Cancer and Leo. A league against Francis I. between the emperor and Henry VIII. The diet of Worms, April 17. Belgrade taken by the Turks, August. The title of "Defender of the Faith," conferred on Henry VIII. Copernicus of Thorn in Prussia, ob. 1543, æt. 60.

1522. The island of Rhodes taken from the Knights by the Turks, Dec. 25. The first voyage round the world, by a ship of Magellan's squadron. Michael Angelo, ob. 1564, æt. 89.

1523. Sweden and Denmark disunited. Paracelsus, ob. 1541, æt. 48.

1524. Clement Marot, ob. 1544, æt. 60. Queen Katharine of England, ob. 1536, æt. 50.

1525. The battle of Pavia, in which Francis I. was taken prisoner, Feb. 24. Julio Romano, ob. 1546, æt. 54. Sir Thomas More, lord chancellor, ob. 1535.

1526. A comet appears from 23d Aug. to 7th Septem. Treaty of Madrid, Jan. 14. The inquisition established in Portugal. Lutheranism established in Denmark. Paul Jovius, ob. 1552, æt. 70.

1527. A large comet appears in Leo on the 11th Aug. The papal territories invaded by Charles V. and Rome taken and plundered, May 6th. Bermuda isles discovered. Francis Rabelais, ob. 1553, æt. 70.

1528. A comet appears in Pisces on the 18th January. Popery abolished in Sweden. Andrew Doria, ob. 1560, æt. 93. Olaus Magnus, ob. 1544.

1529. Four comets and an aurora borealis appear. The diet of Spires, March 15, against the reformers, after which they received the name of Protestants. The treaty of Cambray, Aug. 5. Vienna besieged by the Turks, who are repulsed. J. Geo. Trissino, ob. 1550.

1530. A comet appeared from the 6th August to the 13th Sept. The diet of Augsburg, June 25. Union of the Protestants at Smalcald, Dec. 22. The secretary of state's office instituted in England. Spinning wheel invented by Jurgen of Brunswick. Martin Bucer, ob. 1551, æt. 60.

1531. Post-offices in England. A great earthquake at Lisbon. A comet appeared; see ASTRONOMY, p. 814. Hieronymus Vida, ob. 1566.

1532. The court of session instituted in Scotland. Peace between the emperor and German princes, July 23. A comet appeared; see ASTRONOMY, p. 814. Treaty of Nuremberg, Aug. 2. Lilio Giraldi, ob. 1552, æt. 74.

1533. Authority of the pope abolished in England. An insurrection of the Anabaptists in Westphalia. A comet appeared; see ASTRONOMY, p. 814. Ignatius Loyola, ob. 1556, æt. 65.

1534. The kingdom of Tunis seized by Barbarossa. The Reformation takes place in England, March 30. Julius Cæsar Scaliger, ob. 1558, æt. 75. Anne Bulleyn, queen of England, ob. 1536.

1535. The Reformation introduced into Ireland. Charles Vth's expedition into Africa terminates, Aug. 14. The society of the Jesuits formed. Archbishop Cranmer, ob. 1556, æt. 67. Barbarossa the Turkish general, ob. 1547.

1536. Expedition of James king of Scotland into France. A league against Charles V. between Solyman and Francis. John Leland, ob. 1552. Jane Seymour, queen of England, ob. 1537.

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1537. A comet appeared in Taurus, in May, and was seen 3 weeks. Fracastorius, ob. 1553, æt. 71.

1538. A comet appeared in Pisces from the 17th to the 21st January. A treaty, which lasts 4 years, concluded at Nice between Charles and Francis, June 18. Peter Aretino, ob. 1556, æt. 65.

1539. A comet moving in a retrograde direction was seen in Leo from the 6th to the 17th of May. A rebellion at Ghent. The Bible printed in English. The Cortez in Spain subverted by Charles V. 645 monasteries, &c. suppressed in England and Wales. John Sleidan, ob. 1456. Ann of Cleves, queen of England, divorced 1540.

1540. A comet appeared. Sebastian Cabot discovers the variation of the compass. The order of knights of St John abolished. The society of Jesuits established. Robert Stephens, ob. 1559, æt. 56. Catharine Howard, queen of England, ob. 1542.

1541. A comet appeared. Solyman subjects Hungary. Algiers besieged by Charles, Oct. 21. Melancthon, ob. 1560, æt. 64.

1542. A comet was seen near Constantinople for 40 days. A treaty between Francis I. and Solyman against Charles V. Japan discovered. Hieron. Wolfius, ob. 1580, æt. 64. Scotland invaded by the English, who defeat the Scots at Solway Moss, Nov. 23. Titian Vecelli, ob. 1576, æt. 99.

1543. Mortars and iron cannon made in England. Iron first cast in England. A league between Charles V. and Henry, against Francis I. The academy of Verona founded. California discovered. Pins introduced from France into England. John Calvin, ob. 1564, æt. 55. Catharine Parr, queen of England.

1544. The Imperialists defeated by the French at the battle of Cerisoles, April 11. The crown of Sweden declared hereditary. Treaty of Crespi between the emperor and Francis I. Sept. 18. The reformed religion tolerated in Sweden. Adrian Turnebus, ob. 1565, æt. 53.

1545. A comet was seen in the west for several days. Needles first made in England. Disturbances in Scotland. The English defeated by the Scots at Ancram Muir. The council of Trent begins and lasts 18 years. Conrad Gesner, ob. 1565, æt. 49.

1546. A league against the Protestants between the emperor and the pope. Socinianism springs up in Italy. Camerarius, ob. 1574, æt. 75.

1547. A comet appeared. The elector of Saxony defeated by the emperor at Mulberg, April 24. Fiesque's conspiracy in Genoa. The Scots defeated by the English at Pinkey, Sept. 10. Jerome Cardan, ob. 1575, æt. 75.

1548. War between the Persians and Turks. The interim granted to the Protestants by Charles V. The Reformation advances in Poland. Jo. Genesius de Sepulveda, the restorer of learning in Spain, ob. 1572, æt. 81.

1550. The eldest sons of peers permitted to sit in the House of Commons. Bank of Venice established. Iron bullets first used in England. Stockings first knit in Spain.

1551. A league against the emperor between Henry II.

and Maurice, duke of Saxony. Annibal Caro, ob. 1566.

1552. The treaty of Passau between Charles and the Protestants, July 31. Books of astronomy and geometry destroyed in England as magical. Paul Manutius, ob. 1574, æt. 62.

1553. Queen Mary restores popery in England. Servetus executed for heresy by the council of Geneva. Edward VI. dies July 6, æt. 16. Cardinal Pole, ob. 1558.

1554. A comet appeared for several days with its tail turned towards the east. The Low Countries invaded by the French. The Russians subdue Astracan. Mary of England marries Philip of Spain. Castelvetro, ob. 1571, æt. 66.

1555. A comet appeared. The peace of religion established in Germany, Sept. 25. A league against the Spaniards between the king of France and the pope, Dec. 15. Frederick Commandin, ob. 1575, æt. 66.

1556. A comet appeared; see ASTRONOMY, p. 814. Corsica ravaged by the Turks. Charles resigns his crown to Philip, Jan. 6.

1557. A comet appeared in Sagittarius. Charles retires to a monastery, Feb. 24. Glass first manufactured in England. Battle of St Quintin, at which the French are defeated, Aug. 10. Onuphrius Panvinius, ob. 1563, æt. 39.

1558. A comet appeared in August, near Berenice's hair. The French take Calais, Jan. 8. Queen Mary dies Nov. 17. The reformed religion authorised in England. Ronsard, ob. 1585, æt. 61.

1559. Five large meteoric stones fell at Miscoz in Transylvania. A comet appeared in June for some days. The peace of Chateau-Cambresis. The tranquillity of Europe restored. The queen regent of Scotland persecutes the reformers. George Buchanan, ob. 1582, æt. 76.

1560. A comet appeared in Dec. for 28 days. The civil wars in France begin by the conspiracy at Amboise. Philip removes his court from Toledo to Madrid. A treaty between Elizabeth and the Protestants in Scotland, at Berwick, Feb. 27. Presbytery established in Scotland.

1561. Queen Mary arrives in Scotland after an absence of 13 years. Livonia ceded to Poland. Louis Camoens, ob. 1579, æt. 50.

1562. Prince of Conde defeated at the battle of Dreux, Dec. 19. Peter Ramus, ob. 1572.

1563. War between Denmark and Sweden. The council of Trent terminates Dec. 4. Orleans besieged by the duke of Guise, Feb. 6. The Escurial in Spain built. Slave trade carried on with England. Osorius, ob. 1580.

1564. A comet appeared on the 25th Feb. The beginning of the year fixed to Jan. 1, in France. Peace between France and England, April 9. The first coach made in England by Walter Rippon. See Stowe's *Summary*, p. 287.

1565. The revolt of the Low Countries. The Turks attack Malta. Tintoret, ob. 1594, æt. 82.

1566. Two comets appear. The 39 articles of the church of England established. Hungary ravaged by the Tartars. Theodore Beza, ob. 1605, æt. 86.

1567. A comet appears. Queen Mary marries Bothwell, May 15. Battle of St Denis, Nov 10. Disturbances in Sweden. James Cujas, ob. 1590, æt. 68.

1568. Queen Mary defeated in the battle of Glasgow, May 13; retires into England in the beginning of June, and is imprisoned. The Moors in Spain revolt. The reformed religion tolerated in the Low Countries. Three clockmakers came to England from Delft. Ciaconius, ob. 1581, æt. 56.

1569. A comet appeared in Capricorn on the 8th and 9th November. The battle of Jarnac, May 13; of Moncontour, Oct. 3. Pancirolus, ob. 1591.

1570. A league between Spain, Venice, and the Roman see against the Ottoman Porte. The peace of Germain-en-Laye, in favour of the Huguenots, August 15. Log line used. Carolus Sigonius, ob. 1585, æt. 60.

1571. The Turks take the isle of Cyprus. The Turks defeated at the battle of Lepanto, Oct. 7. Henry Stephens, ob. 1598, æt. 70.

1572. The massacre of the Protestants at Paris, Aug. 24. Cornelius Gemma observes a bright new star in Cassiopeia; see ASTRONOMY. Bodinus, ob. 1585.

1573. War against the Protestants in France. Paul Veronese, ob. 1588, æt. 56.

1574. The Spaniards besiege Leyden. Sebastian of Portugal's expedition against the Moors in Africa. Montagne, ob. 1592, æt. 59.

1575. University of Leyden founded. Russia ravaged by the Turks. Francis Hotomanus, ob. 1590, æt. 65.

1576. The Protestant religion permitted in France. A civil war ensues. Palladio flourished.

1577. Drake circumnavigates the globe, and returns Nov. 3, 1580. A comet appeared; see ASTRONOMY, p. 815. Janus Dousa, ob. 1604, æt. 50.

1578. A large comet appeared in October. The first treaty of alliance between England and the States General, Jan. 7. A long and bloody war between Persia and the Ottoman Porte. Don Sebastian killed at the battle of Alcasar, Aug. 4. Cardinal Baronius, ob. 1607, æt. 69.

1579. The union of Utrecht, which begins the republic of Holland, Jan. 23. Riccoboni, ob. 1600, æt. 58.

1580. The kingdom of Portugal seized by Philip of Spain. A comet appeared; see ASTRONOMY, p. 815. Peter Pithou, ob. 1596.

1581. A meteoric stone of 39 pounds weight fell in Thuringia on the 26th July. University of Edinburgh founded. An edict of the United Provinces against Philip, July 26. Copper money introduced into France. Joseph Scaliger, ob. 1609, æt. 69.

1582. Pope Gregory reforms the Julian calendar. New style introduced into Catholic countries, Oct. 5, being reckoned Oct. 15. A comet appeared; see ASTRONOMY, p. 815. Christopher Clavius, ob. 1612, æt. 75.

1583. A meteoric stone of 30 pounds weight fell at Rosa in Lavadie in January. The first proposal of settling a colony in America. Torquado Tasso, ob. 1595, æt. 51.

1584. Raleigh discovered Virginia. Cape Breton discovered. William prince of Orange murdered at Delft, June 30. Edmund Spencer, ob. 1598.

1585. Carthagena taken by Drake. Greenland discover-

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ed. The treaty of Nonsuch between England and the States General, Aug. 10. A comet appeared; see Astronomy, p. 815.

1586. Babington's conspiracy against Queen Elizabeth. Cavendish's first voyage round the world. Tycho Brahe, ob. 1601, æt. 55.

1587. Queen Mary beheaded, Feb. 8. The battle of Coutras, Oct. 20. An hundred sail of ships in the bay of Cadiz burned by Drake.

1588. The Spanish armada destroyed, July 27. First newspaper in England, dated July 28. The duke of Guise, &c. assassinated. Duelling with small swords introduced into England. Bombshells invented at Venloo; they were first thrown into the city of Watchtendonch in Guelderland, and are said to have been used at Naples in 1495. Henrico Catharino Davila, ob. 1631, æt. 55.

1589. A conspiracy, by Huntly, Crawford, &c. against James, king of Scotland. Peace between the Turks and Persians. Drake's expedition to Spain and Portugal. Henry III. murdered by Clement, July 22. Justus Lipsius, ob. 1606, æt. 58.

1590. A comet appeared; see Astronomy, p. 815. Telescopes invented by Jansen, a spectacle-maker in Germany. An earthquake at Vienna, Sept. 5. The art of weaving stockings invented by Lee of Cambridge. A slitting mill erected at Dartford. The battle of Ivry, which ruined the league, March 4. Stephen Pasquier, ob. 1615, æt. 81.

1591. The university of Dublin founded. Tea first brought into Europe. Mariana, ob. 1624, æt. 87.

1592. Presbyterian church government established by act of parliament in Scotland. Falkland isles discovered.

1593. Marischal College, Aberdeen, founded by George, Earl Marischal of Scotland. Bothwell's conspiracy against King James. A comet appeared; see Astronomy, p. 815. A great plague in London. Cardinal Perron, ob. 1618, æt. 63.

1594 Baron Napier invents logarithms, ob. 1617, æt. 67. The Jesuits banished from France, Dec. 19th. The bank of England incorporated. Isaac Casaubon, ob. 1614, æt. 55.

1595. Drake's expedition against the isthmus of Darien. Discoveries in the Pacific Ocean made by Mendana and Quiros. The Russians make the first discoveries in Siberia. Caribbee isles discovered. Shakespeare, ob. 1616, æt. 53.

1596. The Spaniards take Calais from the French. A great earthquake at Japan. The Spanish fleet defeated by the English, and Cadiz taken. A treaty between England, France, and Holland, against Spain, Oct. 31. A comet appeared. The Stella Mira *in Collo Ceti,* observed by David Fabricius, Aug. 13th. Annibal Caracci, ob. 1609, æt. 40.

1597. A comet is seen from the 19th June till the 8th August. Watches brought from Germany to England. Hungary invaded by the Turks. Cervantes, ob. 1620, æt. 69.

1598. Tyrone's insurrection in Ireland. The edict of Nantes issued in April. The peace of Vervins, June 2d. President de Thou, ob. 1617, æt. 64.

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1599. A comet appears. Sir H. Saville, ob. 1622, æt. 72.

1600. The Gowrie conspiracy. The English East India company established. The battle of Newport, July 2d. A variable star in the neck of the Swan discovered by Jansenius. England first obtains possession of St Helena. William Camden, ob. 1632, æt. 72.

Seventeenth Century.

1601. The siege of Ostend commences June 25th. Ireland invaded by the Spaniards, Sept. 21st. Francis Bacon, ob. 1626, æt. 66.

1602. A comet appears in Cygnus. Byron's conspiracy detected. Decimal arithmetic invented at Bruges. Father Paul Sarpi, ob. 1623, æt. 71.

1603. Manufactures of crystal established in France. Queen Elizabeth dies March 24th, æt. 70. Union of the crowns of England and Scotland. Gruterus, ob. 1627, æt. 67.

1604. Ostend taken by the Spaniards after a siege of three years, Sept 10. Peace between England and Spain. The celebrated dispute between the Pope and the Venetians. A French colony established in Canada. Kepler discovers a new star near the right foot of Serpentarius, in September, which disappeared in the space of a year. Malsherbes, ob. 1628, æt. 76.

1605. The gunpowder plot, Nov. 5th. Coaches began to be in common use in England. Marini, ob. 1625, æt. 56.

1606. A truce of twenty years between the empire and the Ottoman Porte. Papirius Masso, ob. 1611.

1607. A comet appeared; see Astronomy, p. 815. Hudson's Bay discovered. Boccalini.

1608. Colonies sent to Virginia from England.

1609. A truce between the Dutch and Spaniards. The United Provinces acknowledged independent, March 30, O. S. Helvicus, ob. 1617, æt. 36.

1610. The Turks defeated near Babylon by the Persians. War between Russia and Poland. Thermometers invented by Drebbel, a Dutchman. 900,000 Moors banished out of Spain. Galileo first observed three of Jupiter's satellites, Jan. 7. Galileo, ob. 1642, æt. 78. Harriot first observed the spots on the sun, Dec. 8th. Andrew du Chesne, ob. 1640.

1611. War between Sweden and Denmark. The order of Baronets instituted in England, May 22. An earthquake at Constantinople. 200,000 persons died there of the plague. Peace between the Persians and the Turks. Lopez de Vega, ob. 1635, æt. 72.

1612. The Poles defeated by the Russians in Muscovy. The English attempt, without success, to discover a northern passage to China. The French settle in the island of Margna. Ben Jonson, ob. 1638.

1613. Peace between Sweden and Denmark. John Kepler, ob. 1630.

1614. A British colony established in Virginia.

1615. Peace between the Imperialists and the Turks. The Jews ordered to quit France. John Barclay, ob. 1621, æt. 38.

1616. A civil war in France. Virginia settled by Sir Walter Raleigh. Flushing restored by king James to the Dutch. Cape Horn first sailed round. Sir Robert Cotton, ob. 1631, æt. 61.

1617. Peace between Russia and Sweden. Peace between the house of Austria and the Venetians. Dominiquino, ob. 1641, æt. 60.

1618. Peace concluded between Russia and Poland. Two comets appeared; see Astronomy, p. 815. A horrible conspiracy at Venice detected. The battle of Ardeville between the Persians and Turks. The Synod of Dort begins November 1, and continues till April 26, 1619. Fabri de Peiresc, ob. 1637, æt. 57.

1619. The circulation of the blood discovered by Harvey, ob. 1657, æt. 80. A war of thirty years begins in Germany, Aug. 26.

1620. A mass of iron weighing 160 tolahs, fell from the heavens in the Mogul territory, about 100 miles south-east of Lahore. The English settle at Madras. Copper money first used in England. Barbadoes discovered. The Imperialists defeat the Bohemians at Prague, Oct. 30, O. S. Navarre united to France. Coining with a die first used in England. Guido Rheni, ob. 1642, æt. 67.

1621. War between Spain and Holland renewed after a truce of 12 years. Civil war with the Huguenots, lasts 9 years. War between Turkey and Poland. The Dutch establish the settlement of Batavia. The factions of Whigs and Tories arise. Gaspar Barthius, ob. 1648, æt. 71.

1622. Heidelberg taken by the Emperor, and the library sent to Rome, Sept. 16. Peter Paul Rubens, ob. 1640, æt. 63.

1623. The knights of Nova Scotia instituted. The English factory at Amboyna massacred by the Dutch. Sir Henry Spelman, ob. 1641.

1624. The Dutch defeat the Spanish fleet near Lima. Bagdad besieged by the Turks, who are repulsed. Cardinal Bentivoglio, ob. 1644, æt. 65.

1625. A pestilence in England. King James dies at Theobalds, March 27, æt. 59. Dissensions between Charles I. and the House of Commons. The first English settlement in the West Indies. Breda taken by the Spaniards. Peace between Ferdinand of Hungary and the Sultan. John Meursius, ob. 1639, æt. 60.

1626. Peace between the Huguenots and the French king, Feb. 5. N. S. War renewed the following year. A league of the Protestant princes against the Emperor. Gerard John Vossius, ob. 1650, æt. 73.

1627. A meteoric stone weighing 59 pounds, fell on Mount Vaiser in Provence, on the 27th Nov. War between England and France. Ericius Puteanus, ob. 1646, æt. 72.

1628. A meteoric stone weighing 24 pounds, fell at Hatford in Berkshire, on the 9th April. Persia invaded by the Turks. The Duke of Buckingham murdered, Aug. 23. Louis XIII. takes Rochelle, Oct. 18. O. S. Quevedo, ob. 1647.

1629. The English parliament dissolved by Charles I. March 10; nine members imprisoned, March 4. Peace between Denmark and Germany. A truce between Poland and Sweden for 6 years, Sept. 5, O. S. Gustavus Adolphus enters Germany. Peace between England and France. Bahama isles discovered. Inigo Jones, ob. 1651.

1630. Gazettes first published in Venice. Treaty of Stockholm between England and Sweden, May 31. War between Germany and Spain. Poland invaded by the Turks. Grotius, ob. 1645, æt. 62.

1631. A treaty between Sweden and France, Jan. 13, O. S. The Swedes defeat the Imperialists at the battle of Leipsic, Aug. 28, O. S. The vernier index first made known. Clocks and watches generally used. Archbishop Usher, ob. 1655, æt. 75.

1632. War between Sweden and Denmark. Battle of Lutzen, Nov. 6, O. S. where Gustavus Adolphus is killed. A great eruption of Vesuvius. Antigua settled by the English. Gab. Naudé, ob. 1653.

1633. Galileo condemned by the inquisition. The French discovered Louisiana. Anthony Vandyck, ob. 1641, æt. 42.

1634. War between Poland and Prussia. The Swedes defeated by the king of Hungary, at the battle of Nordlingen, Nov. 26, O. S. John Selden, ob. 1654, æt. 70.

1635. The French academy established at Paris. War between France and Spain. A treaty between Holland and France, Feb. 8. Regular posts established in Britain. Gassendi, ob. 1655, æt. 66.

1636. A meteoric stone fell between Sagan and Dubrow in Silesia, in March 8. A treaty between Louis XIII. and the queen of Sweden, March 10, O. S. A truce of 26 years between Sweden and Poland. The Imperialists defeated by the Swedes at Wistock, Oct. 4, O. S. Renes Descartes, ob. 1650, æt. 54.

1637. The Scots withdraw their allegiance from Charles I. War between the Poles and the Cossacs in the Ukraine. A league against Sweden between Spain and Denmark. An insurrection of the Protestants in Hungary. The prince of Orange takes Breda, Sept. 26, O. S. Famianus Strada, ob. 1649.

1638. Bagdad taken by the Turks, Jan. 6. Two battles of Rheinfeld, Feb. 18 and 21, O. S. The solemn league and covenant in Scotland. Petavius, ob. 1652, æt. 69.

1639. The French defeated at Thionville by the Imperialists. May 27, O. S. Horrox first observed a transit of Venus over the sun's disk at Liverpool, Nov. 24, O. S. 3^h 15′ P. M. Voiture, ob. 1648.

1640. England invaded by the Scots, Aug. 20, O. S. and take Newcastle. A conference between the English and Scots commissioners at Rippon, Oct. 2. The independence of Portugal recovered. The long parliament in England met, Nov. 5. Balzac, ob. 1654.

1641. Earl of Strafford beheaded, May 12. The massacre of the Protestants in Ireland, Oct. 23. Chillingworth, ob. 1644, æt. 42.

1642. A meteoric stone weighing 4 pounds, fell near Woodbridge in Suffolk, on the 4th of August. Peace between the Turks and the Imperialists. The Swedes defeat the Imperialists at Leipsic, Oct. 3, O. S. King Charles demands the five members, and the civil war begins. His army defeated at Edgehill, Oct. 23. The French defeated by the Imperialists at Tutelingen, Nov. 15. O. S. Salmasius, ob. 1653.

1643. Bristol surrenders to prince Rupert, July 26. The siege of Gloucester raised Sept. 5. Charles de-

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feated at the first battle of Newbury, Sept. 20. The Tartars invade China. The royal academy of painting founded by Louis XIV. Barometers invented by Torricelli. The prince of Condé defeats the Spaniards at Rocroy, May 9, O. S. Waller's plot in England detected, May 31. Nicholas Poussin, ob. 1656, æt. 62.

1644. The Tartars effect a revolution in China. The Imperialists defeated by the Swedes in Bohemia, Feb. 25, O. S. Cromwell defeats Charles I. at Marstonmoor, July 2. Earl of Essex's army surrenders in Cornwall, Sept. 2. The 2d battle of Newbury, Oct. 27. The Duke of Orleans takes Gravelines, July 18, N. S. Mothe le Vayer, ob. 1671.

1645. War between the Venetians and Turks. Charles I. defeated at Naseby, June 14. Peace between Sweden and Denmark, Aug. 3, O. S. The first code of Russian laws published. Treves taken by Turenne. Duke de Rochefocault, ob. 1680, æt. 68.

1646. A shower of rain, containing great quantities of sulphur, fell at Copenhagen. The Venetians defeated by the Turks near Retimo, Oct. 9, O. S. Paul Scarron, ob. 1660.

1647. A comet appears near Berenice's Hair. Charles I. delivered up to the English commissioners by the Scots, Jan. 30. Henry Hammond, ob. 1660, æt. 55.

1648. The peace of Munster between Holland and Spain, Jan. 20, O. S. The Seven United Provinces declared independent. The Imperialists defeated by Turenne at Augsburg, April 7, O. S. The prince of Condé defeats the archduke at Lens, Aug. 10, O. S. Peace of Munster between France and the emperor, Oct. 14, O. S. The peace of Osnaburgh between Sweden and the emperor. Thomas Hobbes, ob. 1679, æt. 91.

1649. King Charles I. beheaded, Jan. 30. æt. 49. A civil war in Paris, which is blockaded by the prince of Condé. A league between Denmark and the United Provinces. Galileo first applied the pendulum to clocks; see 1656. Samuel Bochart, ob. 1667.

1650. Battle of Dunbar, in which the Scots are defeated by Cromwell, Sept. 3. Mezeray, ob. 1683, æt. 73.

1651. Battle of Worcester, in which Cromwell defeats Charles II. Sept. 3. The Venetians defeat the Turkish fleet near Scio, June 13, O. S. The Poles defeat 300,000 Tartars, June 20. Dr John Wallis, ob. 1703, æt. 87. Archibald, marquis of Argyle, ob. 1661, æt. 63.

1652. The war between the English and Dutch begins, May 19. Naval battle between the English and Dutch near Plymouth, Aug. 16. Van Tromp defeats the English fleet in the Downs, Nov. 29. A comet appeared; see ASTRONOMY, p. 815. The Dutch establish a colony at the Cape of Good Hope. J. Fred. Gronovius, ob. 1671, æt. 58. Chancellor Seguier, ob. 1672, æt. 84.

1653. A naval engagement between the English and Dutch on the coast of France, Feb. 18. Cromwell dissolves parliament, April 20. The English defeat the Dutch in a sea fight on the coast of Flanders, June 3.; and again near the Texel, July 29. Cromwell proclaimed protector, Dec. 16, ob. 1658, æt. 60. Blaise Pascal, ob. 1662, æt. 39.

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1654. Peace between Holland and England, April 5. Air-pump invented by Otto Guericke of Magdeburg. John Milton, ob. 1674, æt. 66. Admiral Blake, ob. 1657. æt. 59.

1655. Admiral Penn takes Jamaica, May. 7. Blake destroys the Spanish galleons at Santa Cruz. The Venetians defeat the Turks in a naval battle at the Dardanelles, June 11, O. S. Huygens discovers the fourth satellite of Saturn, March 25. Peace between England and France, Oct. 25. War between Sweden and Poland. Thomas Bartholin, ob. 1680, æt. 64.

1656. Treaty between the king of Sweden and the elector of Brandenburg, Jan. 11, O. S. England declares war against Spain, Feb. 16. The Poles defeated by the Swedes in three battles at Warsaw, July 18, 19, and 20, O. S. Pendulums said to have been applied to clocks by Fromantil; see 1649. Edmund Waller, ob. 1687, æt. 82. Marshal Turenne, ob. 1675, æt. 64.

1657. War between Denmark and Sweden. A treaty between the king of Poland and the elector of Brandenburg, Sept. 9, O. S. Peter Corneille, ob. 1684, æt. 78.

1658. A shower of sulphur fell in the duchy of Mansfield. Turenne defeats the Spaniards, and takes Dunkirk, June 17. Dunkirk delivered to the English. Hookes' watch with a balance-spring invented. J. Baptista Poquelin Moliere, ob. 1672. Admiral de Ruyter, ob. 1676, æt. 60.

1659. Peace of the Pyrenees between France and Spain, Oct. 28, O. S. Du Cange, ob. 1685, æt. 58.

1660. Peace between Denmark and Sweden, March 17, O. S. The restoration of Charles II. May 29. Peace between Sweden, Poland, and the empire, May 3. The king of Denmark declared absolute, and the throne hereditary, Oct. 13. O. S. Algernon Sydney, ob. 1683, æt 66. General Monk, duke of Albemarle, ob. 1670, æt. 62.

1661. A treaty between the Portuguese and Dutch. A treaty of commerce between Great Britain and Sweden, Oct. 21. The Portuguese cede Bombay to England. A comet appeared; see ASTRONOMY, p. 815. Franking letters began; abridged in 1764 and 1775. Sir John Marsham, ob. 1685, æt. 83.

1662. The Royal Society established, July 15. Dunkirk restored to the French. Samuel Butler, ob. 1680, æt. 68.

1663. Two meteoric stones, one weighing 200 and the other 300 pounds, fell at Verona. Gregorian telescope invented before this. The Royal Academy of Inscriptions and Belles-lettres established. The Spaniards defeated by the Portuguese near Evora. Prussia declared independent on Poland. Charles le Brun, ob. 1690, æt. 71.

1664. War between the English and Dutch. Treaty of Pisa between the king of France and the pope, Feb. 2, O. S. The French defeat the Turks in Hungary, July 22. Observatory at Paris founded. Battle of St Godard, July 22. The Academy for Sculpture established in France, Aug. 31. A comet appeared; see ASTRONOMY, p. 815. Lewis Maimbourg, ob. 1686, æt. 77.

1665. War between England and France. A comet appeared; see ASTRONOMY, p. 815. The English defeat the Dutch in a naval battle near Harwich, June 3. The plague raged in London. The magic lanthorn invented by Kircher. The Spaniards defeated by the Portuguese at Villa Viciosa, June 7, O. S. Ralph Cudworth, ob. 1688, æt. 71.

1666. A comet was seen at Ceylon. A naval engagement between the English and Dutch near Dunkirk, June 1, 4. The English defeat the Dutch fleet near the Thames, July 25, and 26. A fire in London, which extended to 600 streets, and burnt 13,200 houses, Sept. 2. The English settle in Antigua. War declared between England and Denmark. Academy of Sciences established in France. Giles Menage, ob. 1692, æt. 79.

1667. A commercial treaty between Britain and Spain, May 23. The treaty of Breda, July 31. War between France and Spain. Charles de St Evremond, ob. 1703, æt. 90.

1668. A comet appeared on the 7th March in Aries. The Newtonian telescope invented before this: it was exhibited to the king on the 11th Jan. 1672. A treaty of commerce between Britain and Holland, Feb. 17. The triple alliance of Britain, Sweden, and Holland, against France, Jan. 23. Peace between Portugal and Spain, after 26 years of war, Feb. 3, O. S. Peace of Aix-la-Chapelle between Spain and France, April 22, O. S. Benedict de Spinosa, ob. 1678, æt. 44.

1669. The Turks take Candia, Sept. 6, O. S. A treaty of commerce between Britain and Savoy, Sept. 19. Huygens, ob. 1695, æt. 66.

1670. A treaty of commerce between Britain and Denmark, July 11. Peace of Madrid between Britain and Spain, July 18. Hevelius discovered a new star, July 15, which disappeared, and became visible in 1672. Sir Christopher Wren, ob. 1723, æt. 91.

1671. Cassini discovers the sixth of Saturn's satellites in October. Isaac Barrow, ob. 1677, æt. 47.

1672. A comet appears; see ASTRONOMY, p. 815. The Cassegrainian telescope invented before this. France declares war against Holland, April 6. England declared war against Holland, March 17. War between the Poles and Turks. A league against France between the Empire and Holland, July 15, O. S. A severe naval battle between the English and Dutch in Solebay, May 28. Louis XIV. subdues great part of Holland. The prince of Orange made Stadtholder, and J. de Wit put to death, Aug. 12. Cassini discovers Saturn's 3d satellite. Sir W. Temple, ob. 1700, æt. 72.

1673. The Dutch fleet defeated by that of the English and French, May 28, June 14, and Aug. 11. The king of France makes war upon Spain, Oct. 9, O. S. The Poles defeat the Turks near Choczim, Oct. 31. René Rapin, ob. 1687, æt. 66.

1674. Treaty between Britain, Spain, and Holland, Feb 19. Sicily revolts from Spain. The battle of Leneff in Flanders, Aug. 1, O. S. The French first settle in the East Indies. Academy of Soissons established. The Imperialists defeated at Ensheim by Turenne, Sept. 24, O. S. at Mulhausen, Dec. 19, O. S. and at Turkeim, Dec. 27, O. S. Treaty between Britain and Holland, at London, Dec. 11. Dr Thomas Sydenham, ob. 1689, æt. 66.

1675. War between Denmark and Sweden. Turenne passes the Rhine, and is opposed by Monteculi. The Swedes defeated by the Prussians at Fehrbellin, June 8, O. S. Battle of Altenheim, July 22, O. S. Treaty between Britain and Holland at the Hague, Dec. 30. Robert Boyle, ob. 1691, æt. 65.

1676. Meteoric stones fell from a ball of fire into the sea, S. S. W. of Leghorn, on the 21st of May. Carolina planted by English merchants. The king of France makes war upon Denmark, Aug. 28. The French defeat the allied fleet at Palermo, May 23, O. S. The Royal Observatory at Greenwich built. Samuel Puffendorf, ob. 1694, æt. 63.

1677. Meteoric stones fell at Ermansdorf near Roosenhaven, on the 28th May. The commercial treaty of St Germain, between Britain and France, Feb. 24th. The prince of Orange defeated near Cassel by the French, April 1, O. S. The Protestants revolt in Hungary. A comet appeared; see ASTRONOMY, p. 815. The Danes defeated by the Swedes at Landscroon, Dec. 4, O. S. Carlo Maratti, ob. 1713, æt. 88.

1678. A singular darkness at noon, Jan. 12. Alliance of Westminster, between Britain and Holland, March 3. Peace of Nimeguen between France and Holland, July 31, O. S. Peace between France and Spain, Sept. 17. The Tartars attack the Russians. A comet appeared; see ASTRONOMY, p. 815. The popish plot discovered by Oaks, Sept. 6. Daniel George Morhoff, ob. 1691, æt. 53.

1679. The long parliament of England dissolved, Jan. 25. The peace of Nimeguen, between Germany and France, signed Jan. 26, O. S. Peace between Denmark and Sweden, Aug. 23, O. S. An engagement between the English and Moors, which continued eleven days, at Tangier, Nov. 7. John de la Bruyere, ob. 1696, æt. 57.

1680. Charles XI. declared absolute. A comet appeared; see ASTRONOMY, p. 815. Lord Strafford beheaded. John de la Fontaine, ob. 1695, æt. 74.

1681. A comet appeared. Dissensions between the king of England and parliament. Penny post in London began; established by government in 1711; postage increased to 2d. in 1801. Sir George Mackenzie, ob. 1691, æt. 53. James, duke of Monmouth, ob. 1683, æt. 36.

1682. A comet appears; see ASTRONOMY, p. 815. Bouhours, ob. 1702, æt. 74. Marshal Schomberg, ob. 1690.

1683. The Rye-house plot discovered, June 14. A comet appeared; see ASTRONOMY, p. 815. The Turks besiege Vienna. Lord Russel beheaded, July 21st. John Dryden, ob. 1701, æt. 70.

1684. A truce between France and Spain. The duke of Lorraine defeats 150,000 Turks at Weitzen, June 17, O. S. A comet appeared; see ASTRONOMY, p. 815. Cassini discovers the 1st and 2d satellites of Saturn in March. Racine, ob. 1699, æt. 60. George Saville, Marquis of Halifax, ob. 1695, æt. 62.

1685. Revocation of the edict of Nantz, Oct. 12, O. S. Commotions in England and Scotland. Duke of Monmouth defeated at Sedgemore, July 6. Charles II. dies Feb. 6, æt. 55. Vauban, ob.

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1707, æt. 74. Boileau Despreaux, ob. 1711, æt. 75.

1686. The Newtonian philosophy published. An embassy to Louis XIV. from the king of Siam. The grand alliance against France between Britain, Germany, and Holland, May 12. A convention between Britain and Holland against France, Aug. 22. The league of Augsburgh against France, July 11, O. S. A comet appeared; see ASTRONOMY, p. 815. Humphrey Prideaux, ob. 1724, æt. 77.

1687. Telegraphs said to have been invented. They seem to have been proposed in 1663 by the Marquis of Worcester. The crown of Hungary declared hereditary in the house of Austria. Grævius, ob. 1703.

1688. Smyrna destroyed by an earthquake, July 10. The revolution in England begins, Nov. 5. France makes war against Holland, Nov. 23, O. S. Abdication of King James, who retires to France, Dec. 23. The Imperialists take Belgrade by assault. A revolution in Siam. Peter Bayle, ob. 1706, æt. 59.

1689. K. William and Q. Mary proclaimed, Feb. 16. James II. with an army, lands in Ireland. The emperor declares war against France. France makes war upon Spain and England. The French fleet defeated at Bantry-bay, May 1. The grand alliance between King William, the emperor, and the States-General, May 12. K. William defeated at Killicrankie, July 27. Episcopacy abolished in Scotland, July 22. Falkland islands discovered. A treaty between China and Russia. Louis XIV. declares war against Holland. The Imperialists defeat the Turks near Patochin, Aug. 30, and Sept. 24. A comet appeared; see ASTRONOMY, p. 815. John Locke, ob. 1704, æt. 70.

1690. Peace between the czar of Moscovy and the emperor of China. The French, under Tourville, defeat the English and Dutch in a naval battle off Beachy-head, June 30, O. S. Luxembourg defeats the allies at Fleurus, June 21. K. William defeats James II. at the Boyne, July 1, O. S. Bishop Stillingfleet, ob. 1699, æt. 64.

1691. The congress at the Hague, Jan. Louis XIV. takes Mons, March 30, O. S. The battle of Aghrim in Ireland, July 12. Termination of the war in Ireland by the surrender of Limerick, Oct. 3. The Imperialists defeat the Turks, Aug. 9, O. S. A treaty of union between Sweden and Denmark. Twelve thousand Irish Catholics transported to France. Archbishop Tillotson, ob. 1694, æt. 65.

1692. The English fleet defeats the French off La Hogue, May 19. Namur besieged and taken by the French, May 25. Massacre of Glencoe, Jan. 31. The English defeated by Luxembourg at Steinkirk, July 24. Earthquakes in England and in Jamaica, Sept. 8. Bishop Burnet, ob. 1715, æt. 72.

1693. The English and the Dutch defeated by the French in a sea fight off Cape Vincent, June 16. Order of St Louis instituted. The allies defeated by Luxembourg at Landen, July 19. Battle of Marsiglia, Sept. 24. Bossuet, ob. 1704, æt. 78.

1694. Bank of England incorporated. Huy taken, Sept.18. Messina destroyed by an earthquake. The Turks defeated by the Poles at Niester, Sept. 26. Queen Mary dies Dec. 28, æt. 33. Filicaia, ob. 1707, æt. 65. Madam de Maintenon, ob. 1719, æt. 84.

1695. A comet appeared at Macao, with a tail 40 degrees in length. War between the Ottoman Porte and the allies. Namur taken by the allies, July 25. The duke of Savoy takes Casal, May. Malebranche, ob. 1715.

1696. Treaty of Turin between Louis XIV. and the duke of Savoy. The Assassination plot discovered, July 14. Peter I. takes Azof, July 19. J. Dominique Cassini, ob. 1712, æt. 87.

1697. A meteoric stone fell in Switzerland on the 16th March. French take Carthagena, May 26. The Turks defeated by the Imperialists in the battle of Zentha, Sept. 1. The peace of Ryswick, between Britain, France, Holland, and Spain, Sept. 11. Peace between France and the empire, Oct. 20. Henry Dodwell, ob. 1711, æt. 70. John Lobieski dies.

1698. The Czar Peter travels into Holland, England, and Germany. The first treaty of partition between France, Britain, and Holland, signed Aug. 10. A comet appears; see ASTRONOMY, p. 815. Gronovius, ob. 1716, æt. 71. Heinsius, ob. 1720, æt. 79.

1699. Peace of Carlowitz, between Poland, Russia, Venice, and Turkey, Jan. 16. A comet appeared; see ASTRONOMY, p. 815. The Scots attempt an establishment on the coast of Darien. A league against Sweden between Denmark, Poland, and Russia. The Dutch guards sent to Holland. Bishop Lloyd, ob. 1717, æt. 90.

1700. Meteoric stones fell near St Jago in Jamaica. The Dutch and the German Protestants introduce the new style. The crown of Spain transferred to the house of Bourbon. A severe bill against the Papists in England. The treaty of Traventhod between Denmark and Sweden, Aug. The Russians defeated by the Swedes at Narva, Nov. 20. Thrashing machine with flails invented. Mad. Dacier, ob. 1720, æt. 69.

EIGHTEENTH CENTURY.

1701. The coronation of the first king of Prussia, Jan. 7. Academy of Sciences founded at Berlin. An alliance against France between Germany, England, Holland, and Savoy, Sept. 7. A league against the allies between France, Spain, and Portugal. Sir Isaac Newton, ob. 1727, æt. 85.

1702. A comet appeared; see ASTRONOMY, p. 815. War declared against France, in England, Germany, and Holland, May 4. The Imperialists defeated by the French at Luzara, Aug. 4. Landau surrenders to the Imperialists, Aug. 30. Venloo surrendered to the allies, Sept. 25. The French fleet destroyed by the English and Dutch in the port of Vigo, Oct. 12. The French send colonies to the Mississippi. Naval battle between the English and French in the West Indies, Aug. 19. China ware made at Dresden. K. William dies March 8, æt. 52. Prince Eugene, ob. 1736, æt. 73. Fenelon, ob. 1715, æt. 64.

1703. Portugal joins the league against France and Spain,

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May 5. Petersburg founded. A dreadful tempest in England, Nov. 27. Leibnitz, ob. 1716, æt. 70.

1704. The Bavarians defeated by Marlborough at Schellenburg, July 2. Admiral Rook takes Gibraltar, July 24. Battle of Blenheim, in which the allies defeat the French, Aug. 2. Narva taken by the czar of Muscovy, Aug. 10. The English defeat the French fleet off Malaga, Aug. 13. The allies take Landau, Nov. 23. Huet, ob. 1721, æt. 91.

1705. The Spanish fleet defeated by the English off Gibraltar, March 21. Marlborough forces the French lines in Brabant, July 18. The duke of Vendome defeats P. Eugene at Cassano, Aug. 5. Barcelona reduced by the English, Aug. 22. Sir Godfrey Kneller, ob. 1723, æt. 77.

1706. A meteoric stone weighing 72 pounds fell near Louisa in Macedonia, in January. The French defeated by Marlborough at Ramillies, May 12. Marlborough takes Brussels, Louvaine, Bruges, Ghent, Ostend, Menin, &c. The allies take Carthagena, June 13. Union between England and Scotland signed, July 20. P. Eugene defeats the French at Turin, Aug. 27. Peace between Poland and Sweden, Sept. 13. The Spaniards discover the New Philippine isles. A comet appeared; see Astronomy, p. 815. John Flamstead, ob. 1723, æt. 77.

1707. The French defeat the allies at Almanza, April 14. Treaty between the emperor and Sweden in April. The kingdom of Naples seized by the emperor. A conspiracy in Geneva. A comet appeared; see Astronomy, p. 815. And. Dacier, ob. 1722, æt. 71.

1708. Battle of Oudenarde, in which the French are defeated, June 30. Sardinia taken by the allies, Aug. 4. Minorca taken by Gen. Stanhope, Sept. 18. Lisle surrenders to the allies, Oct. 12. Marlborough takes Ghent, Dec. 30. Jo. Vincent Gravina, ob. 1718, æt. 50.

7109. Battle of Pultowa, in which the Swedes are defeated by the Russians, June 27. Tournay taken by the allies, July 30. The French defeated at Malplaquet, Aug. 31. Mons taken by the allies, Oct. 21. Dr Bentley, ob. 1742, æt. 80. Marshal Villars, ob. 1734, æt. 82.

1710. The allies take Douay, June 15. The allies defeat the Spaniards at Almenara, July 27; and at Saragossa, Aug. 9. The English defeated at Brihwega by the duke of Vendome, Dec. 9. Battle of Villa Viciosa, Dec. 10. The Spaniards defeated by Staremberg. Bishop Hare, ob. 1740, æt. 70. R. Harley, earl of Oxford, ob. 1724, æt. 63.

1711. The duke de Noailles takes Girrone, Jan. 23. War declared by the emperor of Russia against the Turks, March 8; a battle between the Turks and Russians, which lasts 3 days. Bouchain taken by Marlborough, Sept. 13. Treaty of Pruth between Peter the Great and Achmet III. Addison, ob. 1719, æt. 48. Lord Bolingbroke, ob. 1751, æt. 73.

1712. Villars defeats the English at Dennin, July 13, and takes Douay, Sept. 8. Negotiations for peace at Utrecht. Sir R. Steel, ob. 1729.

1713. A comet appears. Peace of Utrecht between Britain and Holland, Jan. 29. Peace between Russia and Turkey. A treaty between Britain and Spain, March 26. Peace between Britain and France, between France and the duke of Savoy, between Portugal and France, between Prussia and France, April 11; between France and the States-General, April 12; between Britain and Spain, July 13. Matthew Prior, ob. 1721, æt. 57.

1714. Treaty of Rastadt and of Baden in Switzerland between Germany and France, March 6. Barcelona and Cordova taken by the king of Spain. Treaty of Baden between France, Germany, and Spain, Sept. 7. War declared against Venice by the Turks, Dec. 7. Q. Anne dies, and George I. succeeds to the throne of Great Britain, Aug. 1. Francis Atterbury, bishop of Rochester, banished 1723, ob. 1732, æt. 70.

1715. Treaty of Utrecht between Spain and Portugal, Feb. 13. Morea subdued by the Turks. The barrier treaty between Holland and Germany, Nov. 15. The battle of Prestonpans, Nov. 13; Sheriff-muir, Nov. 13. Prince Charles lands near Aberdeen, Dec. 22. Louis XIV. dies Aug. 21, æt. 77. John Hardouin, ob. 1729, æt. 83. John, duke of Argyle, ob. 1743, æt. 61.

1716. Alliance between Britain and Holland, Feb. 6. The rebellion in Scotland suppressed, April 26. Alliance between Britain and Germany, May 25. War between Germany and Turkey. The Turks defeated by P. Eugene at Peterwaradin, July 25. John Le Clerc, ob. 1736, æt. 79. Philip, duke of Orleans, regent of France, ob. 1723, æt. 51.

1717. A comet appears. Peter the Great arrives in Paris. The triple alliance between Britain, France, and Holland at the Hague, Dec. 24. Prince Eugene defeats the Turks at Belgrade, kills 15,000 men, and takes 130 pieces of cannon. L'Enfant, ob. 1728, æt. 68.

1718. Charles XII. invades Norway. The English defeat the Spaniards in a sea fight near Syracuse, July 31. Treaty of Passarowitz, between the Germans, Venetians, and Turks, July 21. Quadruple alliance between Germany, Britain, France, and Holland, Aug. 2. Britain makes war upon Spain, Dec. 22. A comet appeared; see Astronomy, p. 815. Vertot, ob. 1735, æt. 80. Earl Macclesfield, ob. 1732, æt. 66.

1719. Sicily evacuated by the Spanish troops. Peace between Britain and Spain, June 26. Peace between Poland and Sweden; between Hanover and Sweden, Nov. 20. Battle of Franca Villa, June 9. The Mississippi scheme at its height in France. John Law, ob. 1729, æt. 58. Dr Friend, ob. 1728, æt. 53. Alberoni disgraced, ob. 1752, æt. 88.

1720. A league between England and Sweden, Jan. 21. Peace between Sweden and Prussia, Jan. 21. South Sea scheme begins April 7, and ends Sept. 29. Peace between Denmark and Sweden, June 3. A great earthquake in China, June 11. The Mississippi company in France dissolved, June 27. Pestilence in France. Sardinia ceded to the duke of Savoy, Aug. 7. Montfaucon, ob. 1741, æt. 86.

1721. A shower of sulphur fell in Brunswick in October. Peace between Britain and Spain, June 13. Alliance between Britain, France, and Spain,

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June 13. Peace between Sweden and Russia, Aug. 19. Dr S. Clarke, ob. 1729, æt. 54. Sir R. Walpole, ob. 1745, æt. 71.

1722. The English make peace with the Moors, Aug. 12. A revolution in Persia, Oct. 12. The czar assumes the title of Emperor of Russia. Roggewein makes discoveries in the Pacific Ocean. The Christians and Jesuits expelled from China. Dr Jonathan Swift, ob. 1745, æt. 78.

1723. Thirty-three meteoric stones fell near Plestowitz in Bohemia, on the 22d June. A comet appeared; see ASTRONOMY, p. 815. Dr Edmund Halley, ob. 1742, æt. 82. Duke of Marlborough dies, æt. 73.

1724. Earthquake in Denmark. Persecution of the Protestants in France. An Academy of Sciences established at St Petersburg. Philip V. resigns his kingdom to his son Lewis, Jan. 15. John Albertus Fabricius, ob. 1736, æt. 67. Duke de Riperda disgraced 1726, ob. 1737.

1725. Treaty of Vienna, between the emperor and the king of Spain, April 31. War between Persia and Turkey. Treaty of Hanover, between Britain, France, and Prussia, against Germany and Spain, Sept. 3. Dr John Arbuthnot, ob. 1735. Cardinal Fleury, ob. 1743, æt. 90.

1726. An earthquake at Palermo, Aug. 21. Boerhaave, ob. 1738, æt. 70.

1727. Treaty of Copenhagen, between Britain, Denmark, &c. April 16. Peace between Turkey and Persia. Aberration of the fixed stars discovered by Dr Bradley. Siege of Gibraltar begun by the Spaniards May 20, and continued till April 1728. King George I. dies June 11, æt. 68. Dr Chandler, ob. 1750, æt. 83. Dr Bradley, ob. 1762, æt. 70.

1728. Treaty of Westminster, between Britain and Holland, May 27. A colony of Danes passed into Greenland. A great fire in Copenhagen. An earthquake in China, September. Cardinal Polignac, ob. 1741, æt. 80. Sir R. Temple, ob. 1749, æt. 74.

1729. A comet appeared; see ASTRONOMY, p. 815. The treaty of Seville, between Britain, France, and Spain, Nov. 9. Bishop Gibson, ob. 1743, æt. 79.

1730. War between Persia and Turkey. An earthquake in China. A revolution at Constantinople, September. The Persians under Kouli-Khan gain a signal victory over the Turks. Bishop Hoadly, ob. 1761, æt. 85.

1731. A treaty between Britain and Germany, Mar. 16. A new treaty between Germany, Britain, and Spain, July 22. Alliance between the electorates of Hanover and Saxony, August. A great earthquake at Naples. Alexander Pope, ob. 1741, æt. 80.

1732. The Spanish fleet defeats the Moors on the coast of Barbary, June 20. The Pragmatic sanction confirmed by the diet of the empire, Jan. 11. Rollin, ob. 1741, æt. 80.

1733. Jesuits expelled from Paraguay, January. A war between Germany and France. A treaty between France, Spain, and Sardinia. Abbé du Bos, ob. 1742, æt. 72.

1734. A battle between the Turks and Persians. The Imperialists defeated by the French at Parma, June 18. The French take Philipsburg, July 7. Dantzic submits to Augustus, July 10. The king of Sardinia defeats the Imperialists at Guastalla, Sept. 19. A commercial treaty between Britain and Russia, Dec. 2. Fontenelle, ob. 1756, æt. 100. W. Pulteney, ob. 1764, æt. 81.

1735. Alliance between Sweden and Denmark. The Turks defeated by the Persians. Preliminaries of peace between France and Austria signed Oct. 3. Dr Sherlock, ob. 1761, æt. 84.

1736. Peace between Austria and Spain. War between Russia and Turkey. Kouli Khan proclaimed king of Persia, by the title of Shah Nadir, Sept. 29. Lagrange born, 25th June. Bishop Berkeley, ob. 1753, æt. 73.

1737. A comet appeared; see ASTRONOMY, p. 815. The emperor, along with Russia, makes war upon the Turks, July 2. A dreadful hurricane at the mouth of the Ganges, Oct. 10. Colin Maclaurin, ob. 1746, æt. 48. Philip, Earl of Hardwicke, ob. 1764, æt. 74.

1738. The Russians invade the Crimea. Treaty of Vienna between the emperor and the king of France, Nov. 18. James Thomson, ob. 1748, æt. 48. Lord President Forbes, ob. 1747, æt. 62.

1739. Shah Nadir obtains possession of the empire of the Moguls. Treaty between Britain and Denmark. A comet appeared; see ASTRONOMY, p. 815. The Russians defeat the Turks at Choczim, Aug. 8. Peace between Germany and Turkey, Aug. 21.; between Russia and Turkey, Nov. War between England and Spain declared, Oct. 23. Porto-Bello taken by Vernon, Nov. 21. Treaty of Versailles between France and Holland, Dec. 21. Bishop Butler, ob. 1752, æt. 60.

1740. War between Hungary and Poland. Peace between Persia and Turkey, October. The emperor Charles VI. dies, Oct. 9, which begins the general war in Germany, that lasts eight years. Henry Fielding, ob. 1754, æt. 48. Arthur Onslow, ob. 1768, æt. 78.

1741. Prussians defeated by the Imperialists at the battle of Molwitz, March 30. War between Russia and Sweden. Carthagena taken by Vernon, June 19. The Prussians seize Silesia, Oct. 20. Charles de Secondat Baron Montesquieu, ob. 1755, æt. 67.

1742. Two comets appeared; see ASTRONOMY, p. 815. Battle of Czaslaw, between the Austrians and Prussians, May 6. Peace between Prussia and Austria. Prague besieged by the Austrians, Aug. 16. to Dec. 16. Alliance between Britain and Prussia, Nov. 18. Dr Stephen Hales, ob. 1761, æt. 82.

1743. War between the Turks and Persians. The battle of Campo Santo, Jan. 17. The allied army defeats the French at the battle of Dettingen, June 16. Alliance between Britain and Russia, February. A plague in Sicily, May. War between the British, French, Austrians, and Hungarians. Peace between Russia and Sweden at Abo, Aug. 17. A comet appeared; see ASTRONOMY, p. 815. An alliance between Britain, Hungary, &c. at Worms, Sept. 13. Alliance between Britain and Russia, Dec. 11. G. Frederick Handel, ob. 1759, æt. 56.

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1744. A comet appeared; see ASTRONOMY, p. 815. The attempt of the French to invade Britain defeated, Feb. 24. Naval engagement between the French and English fleets off Toulon, Feb 22. War between Britain and France. War between Hungary and France, April 17. Surrender of Menin, June. The king of Prussia takes Prague, Sept. 16. Friburg surrenders to the French, Nov. 1. Commodore Anson completes his voyage round the world. Henry Pelham, ob. 1754, æt. 60.

1745. Quadruple alliance between Britain, Austria, Holland, and Poland, Jan. 8. The Austrians defeat the French at Psaffenhofen, April 4. Battle of Fontenoy, April 30. Shah Nadir defeats the Turks at Erzerum in May. The Prussians defeat the Austrians at Striegau, June 4. The French take Tournay, Ghent, Bruges, Oudenarde, Dendermonde, Ostend, Newport, and Aeth, beween June 8. and Oct. 9. The English take Louisbourg and Cape Breton, June 6. The rebellion in Scotland begins in July. The Austrians defeated by the Prussians at Sohr, Sept. 19. Battle of Prestonpans, Sept. 21. Treaty of Dresden, between Austria, Prussia, Poland, and Saxony, Dec. 25. The duke of Cumberland takes Carlisle, Dec. 30. Dr Middleton, ob. 1750, æt. 67. Marshal Saxe, ob. 1750, æt. 54.

1746. Battle of Falkirk, Jan. 17. Peace between Persia and Turkey in January. Count Saxe takes Brussels, Feb. 20. and soon after Antwerp. Battle of Culloden, April 16. Alliance of Petersburg, between Russia and Austria, May 22. The prince of Conti takes Mons, July 10, and Charleroi, Aug. 2. Namur taken by Count Clermont, Sept. 19. The allies defeated by Saxe at Reucoux, Oct. 11. Lima destroyed by an earthquake, Oct. 17. Hogarth, ob. 1764, æt. 67. Duke of Cumberland, ob. 1765, æt. 45.

1747. Anson and Warren defeat the French fleet, May 3. A comet appeared; see ASTRONOMY, p. 815. The prince of Orange elected Stadtholder of the United Provinces, May 2. Alliance of Stockholm, between Prussia, Poland, and Sweden, May 29. Admiral Hawke defeats the French fleet, Oct. 14. The French take Bergen-op-Zoom, Sept. 5. Kouli Khan murdered. A revolution in Persia. James Cassini, ob. 1756, æt. 79. Lord Anson, ob. 1762, æt. 62.

1748. Two comets appeared; see ASTRONOMY, p. 815. The French take Maestricht, May 7. Peace of Aix-la-Chapelle, between Britain, France, Spain, Austria, Sardinia, and Holland, Oct. 7. Benjamin Robins, ob. 1751, æt. 44. Sir John Barnard, ob. 1764, æt. 80.

1749. Nova Scotia colonized. A league against the Corsairs of Algiers and Tunis, between the Pope, Venetians, &c. La Place born, March 23. Bouguer, ob. 1758, æt. 61. Philip, earl of Chesterfield, ob. 1773, æt. 79.

1750. A large meteoric stone fell on St Peter's day at Niort, near Constance in Normandy. Two shocks of an earthquake in England, Feb. 8, and March 8. An academy of sciences founded at Stockholm. Treaty of commerce between Spain and Britain, Oct. 5. Belidor, ob. 1761, æt. 64. Earl Bathurst, ob. 1775, æt. 91.

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1751. Two meteoric stones, one weighing 71, and the other 16 pounds, fell in the district of Agram in Croatia. Peace between Portugal and Spain. Frederic, prince of Wales, dies, March 20, æt. 44. Thomas Simpson, ob. 1761.

1752. Franklin discovers the identity between electricity and lightning. The new style introduced into Britain, Sept. 3. reckoned the 14th. La Caille, ob. 1762, æt. 49. Franklin, ob. 1790, æt. 85.

1753. Meteoric stones fell near Eichstadt in Germany, on January. Other two, one of 20, and another of 11 pounds weight, fell in Bresse-bock, in September; and a shower of stones fell on the 3d July, near Tabor in Bohemia. The British Museum established by act of parliament. China ware made at Chelsea. Dr Edward Young, ob. 1765, æt. 83.

1754. A dreadful eruption of Ætna. A great earthquake at Constantinople, &c. Sept. 2. Dr John Leland, ob. 1766, æt. 75. John duke of Bedford, ob. 1771, æt. 61.

1755. A meteoric stone fell in the country of Terra Nova, weighing 7½ pounds. War between the Algerines and Dutch, April 10. Quito destroyed by an earthquake, April 28. Braddock killed near Fort de Quesne, July 9. A convention between Britain and Russia, Sept. 30. Lisbon destroyed by an earthquake, Nov. 1. Dr Birch, ob. 1766, æt. 61. Admiral Boscawen, ob. 1761, æt. 50.

1756. Treaty between Britain and Prussia, Feb. 16. England makes war upon France, May 17. A naval engagement between the English and French off Minorca, May 20. Minorca surrendered to the French, June 28. Oswega taken, Aug. 14. Dr Robert Smith, ob. 1768, æt. 79. William Pitt, earl of Chatham, ob. 1778, æt. 70. The Austrians defeated at Lowoschutz, by the king of Prussia, Oct. 1.

1757. Damien's conspiracy against the French king, Jan. 5. The king of Prussia invades Bohemia. The king of Prussia defeats the Austrians at the battle of Prague, May 6. The battle of Kollin, June 18, in which the king of Prussia is repulsed by count Daun. The battle of Plaissy, in the East Indies, June 23. The battle of Hastenbeck, July 26, in which the French defeat the allies. The French take Verdun, Aug. 26, and Bremen, 3 days afterwards. The convention of Closter-seven, Sept. 8. A comet appeared; see ASTRONOMY, p. 815. The battle of Rosbeck, Nov. 5, in which the Prussians defeat the French and Austrians. The Austrians defeat the Prussians near Breslaw, Nov. 22. The Prussians defeat the Austrians at Lessa, Dec. 5; take Breslaw, Dec. 21; and become masters of Silesia. Archbishop Secker, ob. 1768, æt. 75.

1758. Minden reduced by Pr. Ferdinand, March 14. A treaty between Britain and Prussia, April 11. The English take Senegal, May 1. The French defeated by Pr. Ferdinand at Crevelt, June 23. The English repulsed at Ticonderago, July 8. The English take Louisburg, July 27, and Cherburg, Aug. 6. The Prussians defeated at Frankfort, Aug. 12, and at Hockkirchen, Oct. 14, by the Austrians. The Russians defeated by the Prussians, at Zorndorf, Aug. 25. The allies defeated at Landwernhagen, Oct. 10. The Prussians raise the sieges of Colberg, Neiss, Cosel, Torgau, Leipsic, and Dresden, in Oct. A treaty between Britain and Prussia, Dec. 7. P. Francis Courayer, ob. 1776, æt. 79. General Wolfe, ob. 1759, æt. 33.

1759. A comet appeared; see ASTRONOMY, p. 815. Ferdinand defeats the French at Bergen, April 13. Fort Niagara reduced by Sir W. Johnson, July 24. Battle of Minden, at which the French are defeated, Aug. 1. The king of Prussia defeats the Russians at Cunersdorf, August 12. The Jesuits banished from Portugal, Sept. 3. General Wolfe defeats the French, and takes Quebec, Sept. 17. The French fleet defeated by Boscawen off Gibraltar, Aug. 18. The French fleet defeated off Belleisle, Nov. 20. A comet appeared; see ASTRONOMY, p. 815. Balbec and Tripoli destroyed by an earthquake, Dec. 5. A comet appeared; see ASTRONOMY, p. 815. Bishop Pearce, ob. 1774, æt. 84. Henry Fox, lord Holland, ob. 1774, æt. 69.

1760. The French defeat the English at Quebec, April 28. The French defeated by the allies at Lydorf, July 16, and at Warbourg, July 31. The Prussians defeated by the Austrians at Landshut, June 23. The French defeat the allies at Corbach, July 10. The Prussians defeat the Austrians at Pfaffendorf, Aug. 15. The Prussians defeat the Austrians in Saxony, Aug. 30, and at Torgau, Nov. 3. The English obtain possession of Canada, Sept. 8. Berlin plundered by the Austrians and Russians, Oct. 9. Earthquakes in Syria, Oct. 13. George II. dies, Oct. 25, æt. 77. Voltaire, ob. 1778, æt. 84.

1761. Col. Coote takes Pondicherry, Jan. 15. The French defeat the Hanoverians, &c. near Grunberg, March 21. The English take Belleisle, June 7. The French defeated at Kirchdenckern, July 15. A league between France and Spain, Aug. 15. The Russians defeated at Colberg, Sept. 16. King George III. crowned, Sept. 22. Lord Lyttelton, ob. 1773 æt. 64. Charles Townshend, ob. 1767, æt 42.

1762. War with Spain, Jan. 3. Martinique surrenders, Feb. 4; Grenada, &c. March 4. Peace between Prussia and Russia, March 5. War between Spain and Portugal, May 23. A comet appeared; see ASTRONOMY, p. 815. War declared by France and Spain against Portugal, June 20. The French defeated at Grabenstein, June 24. A revolution in Russia, July 9. The English take the Havannah, Aug. 12. Prince of Wales born, Aug. 12. The Jesuits expelled from France in August. The French defeat Prince Ferdinand at Johannesberg, Aug. 30. A battle between the allies and French at Brucher-muhl, Sept. 21. The English take Manilla, Oct. 6. Schweidnitz surrenders to the Prussians, Oct. 9. The allies defeated by Pr. Henry at Freyberg, Oct. 29. The allies besiege and take Cassel, Nov. 1. Peace between Britain and France, Nov. 3. Condamine, ob. 1774, æt. 74.

1763. The peace of Paris, between Britain, France, and Spain, acceded to by Portugal, Feb. 10. The peace of Hubersburg between Prussia and Hungary, Feb. 15. Peace between Prussia and Poland, Feb. 15. Wedgewood's improvements in pottery.

1764. A comet appeared; see ASTRONOMY, p. 816. A treaty between Russia and Prussia, April 15. Stanislaus Poniatowsky elected king of Poland, Sept. 6. Famine and the plague in Italy. An earthquake at Lisbon, Dec. 26. Byron makes discoveries in the Pacific Ocean. C. V. Linné, ob. 1778, æt. 70.

1765. The regency bill passed, May 15. Bengal established under the British government. D. of Cumberland dies, Oct. 31. The Dauphin dies, Dec. 20. Dr Rutherforth, ob. 1771. James Stuart, the Pretender, dies.

1766. A meteoric stone fell in summer at Alboreti near Modena. A comet appeared; see ASTRONOMY, p. 816. The stamp act repealed in America, March 18. In consequence of an insurrection in Spain, the king leaves Madrid, March 25. A comet appeared; see ASTRONOMY, p. 816. A treaty of commerce between Britain and Russia, June 20. A great earthquake at Constantinople. The Jesuits banished from Bohemia and Denmark. David Hume, ob. 1776, æt. 66.

1767. The Jesuits banished from Spain, Genoa, and Venice, April 2. Martinique almost destroyed by an earthquake. Toleration of the Protestants in Poland, Nov. 2. Wallis and Carteret make discoveries in the Pacific ocean. Jean Jacques Rousseau, ob. 1778.

1768. A meteoric stone, weighing 7½ pounds, fell near Luce, in the district of the Main, on the 13th September. Another meteoric stone fell on the 20th Nov. at Manerkerchen, near the Inn in Bavaria, weighing 38 pounds. The Royal Academy of Arts established in London. The Turks make war upon Russia. The Jesuits banished from Naples, Malta, and Parma. Bougainville makes discoveries in the Pacific Ocean. David Garrick, ob. 1779, æt. 63. Robert lord Clive, ob. Nov. 22, 1774.

1769. Battles of Choczim, April 30, July 13, Sept. 17. The Russian fleet enters the Mediterranean in Dec. Paoli fled from Corsica, June 13, which was reduced. A comet appears; see ASTRONOMY, p. 816. Thomas Gray, poet, ob. July 30, 1771.

1770. The Turks defeated by the Russians, near the Pruth, Aug. 1. An earthquake at St Domingo. Bender taken by storm, Sept. 28. A comet appears; see ASTRONOMY, p. 816. Oliver Goldsmith, ob. April 14. 1774. Edward lord Hawke, ob. Oct. 17. 1781.

1771. About 500,000 Tourgouths emigrate from the border of the Caspian, to the frontiers of China. Lord Mayor of London committed to the Tower, March 27. The Russians burn the Turkish fleet at Cisme, Natolia, July 5. Two comets appear; see ASTRONOMY, p. 816. Bishop Warburton, ob. July 7. 1779. Lord Ashburton, ob. Aug. 18, 1783. Dr Smollet, ob. æt. 61.

1772. A revolution in Denmark, and the queen imprisoned, Jan. 17. Insurrection at Christianstadt, which effects a revolution in Sweden, Aug. 13, and completed at Stockholm, Aug. 19. Poland partitioned by Russia, Prussia, and Austria. A comet appears; see ASTRONOMY, p. 816. Dr W. Hunter, anatomist, ob. March 15, 1783. Sir George Saville, ob. Jan. 1784.

1773. A meteoric stone, weighing 9½ pounds, fell at Sena in Arragon on the 17th Nov. Cook makes

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discoveries in the Pacific Ocean. The order of the Jesuits suppressed by a papal bull, Aug. 25. Disturbances in America begin at Boston, Dec. 18. A comet appears; see ASTRONOMY, p. 816. D'Alembert, ob. Oct. 27, 1783. Capt. Cook, ob. Feb. 14. 1779.

1774. Boston port-bill passed, March 31. Louis XV. dies May 10, æt. 64. Turkish army destroyed, June 20. Peace between Russia and Turkey, July 21. The ancient parliament of Paris restored, Nov. 12. A comet appeared; see ASTRONOMY, p. 816. L. Euler, ob. Sept. 1783. Charles Stuart, Pretender, ob. March 3, 1788.

1775. Hostilities in America begin at Lexington, April 19. Battle of Bunker's Hill, June 17. St John's taken by Montgomery, Nov. 2. Assault of Quebec, Dec. 31. Dr S. Johnson, ob. Dec. 13, 1784.

1776. General Howe leaves Boston, March 17. Congress declares itself independent, July 4. Attack on Charlestown, June 28. Battle on Long Island, Aug. 27. New York taken, Sept. 15, and Fort Washington, Nov. 16. Rhode island occupied, Dec. 8. Austria grants religious toleration, and abolishes torture. Bishop Lowth, ob. Nov. 1787. Dr Adam Smith, ob. 1790, æt. 67.

1777. General Burgoyne takes Ticonderoga, July 6. General Howe lands in Chesapeak Bay, Aug. 30 Battle on the Brandywine, Sept. 11. The British take Philadelphia, Sept. 26. Battle of German town, Oct. 4. Surrender of general Burgoyne's army, Oct. 16. Buffon, ob. April 16, 1788.

1778. Treaty between France and America, Feb. 6. Evacuation of Philadelphia, June 18. War between Austria and Prussia, July 7. Battle between the English and French fleets, July 27. Rhode Island besieged, Aug. 9 to 30. Pondicherry taken, Oct. 17. French routed at St Lucia, Dec. 18. M. Diderot, ob. April 1785.

1779. Meteoric stones fell at Pettiswood in Westmeath, in Ireland. Peace between the Prussians and Imperialists, May 13. The French take St Vincent's, June 17. Naval engagement between Byron and d'Estaing off Grenada, July 6. A dreadful eruption of Vesuvius, Aug. 8. Gibraltar besieged by the Spaniards in July. A comet appears; see ASTRONOMY, p. 816.

1780. Sir George Rodney takes 22 sail of Spanish ships, Jan. 8, and engages Langara, Jan. 16, near Cape Vincent. Naval battle between the English and French, off Martinique, April 17. Charlestown surrenders to the British, May 12. The French and Spanish fleets take five British East Indiamen, and a large fleet of West India ships, Aug. 9. Lord Cornwallis defeats the Americans at Cambden, Aug. 16. Torture abolished in France, Aug. 25. A dreadful hurricane in the Leeward islands, in Oct. War with Holland, Dec. 20. A comet appears; see ASTRONOMY, p. 816. Sir W. Blackstone, ob. æt. 57.

1781. St Eustatia taken by the British, Feb. 3, and retaken, Nov. 17. The Georgium Sidus discovered by Dr Herschel, 13th March. Cornwallis defeats the Americans, at Guildford, March 15. Battle of the Dogger bank, between the English and Dutch fleets, Aug. 5. Cornwallis's army surrenders to the Americans, at York town, Oct. 19. Muslins made in England. Two comets appear; see ASTRONOMY, p. 816.

1782. The Spaniards take Minorca, Feb. 4. A battle between the English and French fleets near Trincomalee, Feb. 17. The French fleet under De Grasse, defeated by Rodney, April 12. The Spaniards besiege Gibraltar from 1780 to Sept. 13. 1782, when their floating batteries were burnt by red-hot balls. M. D'Anville, ob. æt. 80. Lord Kaimes, ob. æt. 86. Metastasio, æt. 84. D. Bernoulli, æt. 82.

1783. Preliminaries of peace between Britain, France, and Spain, Jan. 20, and America declared independent. Armistice between England and Holland, Feb. Definitive treaty, Sept. 8. Messina, &c. destroyed by an earthquake, Feb. 5. A comet appears; see ASTRONOMY, p. 816.

1784. Peace ratified with America, March 24, and with Holland, May 24. Archindschan, in Turkey, destroyed by an earthquake, and 12,000 inhabitants buried in its ruins, July 18. Two comets appear; see ASTRONOMY, p. 816.

1785. About 2000 religious houses suppressed by the emperor of Germany. An earthquake in Calabria, April 10. A severe frost in Germany, which lasted 115 days. A violent storm in France, Aug. 5, which laid waste 131 villages and farms. Two comets appear; see ASTRONOMY, p. 816. Dr Matthew Stewart, ob. æt. 68.

1786. Torture abolished in Sweden. Cardinal Tourlone, the high inquisitor at Rome, hung on a gibbet 50 feet high. Treaty of commerce with France, signed Oct. 29. An earthquake in Scotland, and north of England, Aug. 11. A plague in the Levant. A comet appears. See ASTRONOMY, p. 816.

1787. The settlers of Botany Bay first sailed from England, March 21. Banks established in the East Indies. Earthquake in New Spain, April 18. The Prussians take Amsterdam, Oct. 9. France and England agree to disarm, Oct. 9. Contest between the king of France and the parliament begins. Christiana nearly destroyed by fire, April 9. The 2d and 4th satellites of the Georgium Sidus discovered by Dr Herschel, Jan. 11th. A comet appeared; see ASTRONOMY, p. 816. Bishop Lowth, ob. æt. 77.

1788. War between Turkey, Germany, and Russia. Treaty between Britain and Russia, Jan. 13. The United States of Holland guarantee the stadtholdership to the Prince of Orange, June 27. Russia makes war upon Sweden, June 30. Choczim taken, Sept. 29. Kirkwall nearly destroyed by the breaking down of the dam-dykes, Oct. 4. Assembly of the French notables, Nov. 6. Oczakow taken, Dec. 17. Island of Formosa shakes off the Chinese yoke, and 10,000 Chinese massacred. Two comets appear; see ASTRONOMY, p. 816.

1789. Insurrections in France, March. States-general of France assembled, May 5. The French fleet dispersed by a storm in Bantry Bay, in an attempt upon Ireland, Jan. The French king makes concessions, June 28. Revolution in France, which is declared a republic, July 3. Bastile destroyed, July 14. Insurrection in Brabant, Aug. 10. Meteoric stones fell at Barbotan near Bourdeaux, and killed a herdsman

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and a bullock, on the 20th August. Bender taken, Oct. 8. Surrender of Ghent, Nov. 23, and of Brussels, Dec. 12. Earthquake in Tuscany, which caused great devastation, Sept. 30. Dr Herschel discovers the 6th and 7th satellites of Saturn.

1790. A great shower of meteoric stones fell in the south of France, on the 24th of July. Assignats issued in France, April 17. About 4500 religious houses suppressed in France. Titles of honour abolished in France. Earthquake in Westmoreland, March 6. Two comets appear; see ASTRONOMY, p. 816. Dr Cullen, ob. æt. 77. General Roy, ob. Dr Henry, ob.

1791. Political riot in Birmingham, July 14. The king, queen, and royal family of France, attempting to escape out of the kingdom, are brought back prisoners to Paris, June 21. Insurrection of 35,000 negroes at St Domingo, Sept. Protestants allowed to have churches in France. Bangalore taken by Cornwallis. Battle of Seringapatam. The French defeated by the Austrians near Mons, April 30. At Constantinople, 32,000 houses were destroyed by an earthquake between March and July. Earthquake in Scotland, in October; in Sicily and Calabria, October; at Lisbon, November 27; at Zant, in the Adriatic, December 2. City of Washington in America founded. An act in favour of the Roman Catholics passed. Dr Price, ob. æt. 68.

1792. France declares itself a republic. Leopold, emperor of Germany, poisoned, March 1. King of Sweden assassinated, March 16. Earthquake in the counties of Bedford, Leicester, Lincoln, Nottingham, &c. March 2. The lake of Harentoren, which is a mile in circuit, in Kerry, sinks into the ground, March 25. The king of France renounces his crown, Aug. 10, and is confined in the Temple. Battle of Seringapatam between Tippoo and Lord Cornwallis. The Austrians defeated at Longwy, Aug. 14. The French defeated at Grand-pre, Sept. 10. Battle of Valory, French and Austrians, Sept. 20; of Menehould, French and Prussians, Oct. 2; of Hanau, Oct. 27; of Bossu, Nov. 4; of Jemappe, Nov. 6; of Thirlemont, Nov. 17. The French take Liege. J. Smeaton, ob. æt. 68. Sir J. Reynolds, ob. æt. 68. Sir R. Arkwright, ob.

1793. Holland invaded by the French. King of France tried, Jan. 19, condemned Jan. 20, and put to death, Jan. 22. A piece of land in Finland, 4000 square ells in extent, sunk 15 fathoms in Feb. Queen beheaded, Oct. 16. The English, Prussians, Austrians, Sardinians, and Italian States, make war upon France. Admiral Hood takes Toulon. Battle of Hockheim, Austrians and French, Jan. 7; of Aldenhoven, Feb. 28; of Aix-la-Chapelle, Jan. 15; of Tongres, March 4; of Jurvienden, March 18; of Thirlemont, March 19; of Lovaine, March 22; of Coblentz, April 1; of Cassel, April 7; of Tournay, Austrians, English, and French, May 8; of St Amand, May 10; of Valennes, allies and French, May 23; of Manheim, May 30; of Furnes, Dutch and French, June 21, and Austrians and French, June 26; of Villiers, July 18; of Cambray, Aug. 9; of Lincelles, Aug. 18; of Furnes, Aug. 21; of Rexmond, Aug. 29; of Dunkirk, English and French, Sept. 7; of Quesnoy, Sept. 11; of Limbach, Austrians and French, Sept. 12; of Menin, Sept. 15; of Toulon, English and French, Oct. 1; of Weissenburgh, Austrians and French, Oct. 14; of Maubeuge, allies and the French, Oct. 16; of Birlemont, Oct. 16; of Orchies, Oct. 20; of Wanzenaw, Oct. 25; of Landau, Nov. 29; of Toulon, which surrenders to the French, Nov. 19; of Lebach, Nov. 27; of Rousillon, Spaniards and French, Dec. 11; of Perpignan, Dec. 20. The French under Moreau take Ypres, June 17. Earthquake at Domingo, April; at Shaftesbury and Salisbury, Sept. 29. Two comets appear; see ASTRONOMY, p. 816. Principal Robertson, ob. æt 72.

1794. Twelve meteoric stones fell near Sienna in Tuscany, on the 16th of June. Insurrection of the negroes at St Domingo. Slave trade abolished by the French, Feb. 4. The French take Aix-la-Chapelle, Sept. 21. Antwerp taken, July 24. Battle of Oppenheim, between the allies and French, Jan. 8; of Waterloo, Jan. 23; of Werwick, March 1; of Bayonne, Spaniards and French, March 19; of Perle, allies and French, March 22; of Cateau, March 28; of Cracow, Russians and Poles, April 4; of Durkheim, allies and French, April 5; of Piedmont, Sardinians and French, April 6; of Crombeck, allies and French, April 14th; of Arlon, April 17; of Warsaw, Russians and Poles, April 21; of Landrecy, allies and French, April 24; of Cambray, English and French, April 24; of Cateau, April 26; of Courtray, allies and French, April 29; of Ostend, May 5; of Montesquan, Spaniards and French, May 1; of Aosta, Sardinians and French, May 2; of Saorgia, May 8; of Tournay, English and French, May 18; of Bouillon, allies and French; of Tournay, May 22; of Lautern, May 23; of Lithuania, Russians and Poles, June 3; of Piliczke; of Barcelona, Spaniards and French, June 14; of Charleroi, Dutch and French, June 17; of Cracow, Prussians and Poles; of Aost, Sardinians and French, June 26; of Puycerda, Spaniards and French, June 26; of Manheim, allies and French, July 12; of Fontarabia, Spaniards and French, Aug. 2; of Bellegarde, Spaniards and French, Aug. 26; of valley of Leira, Sept. 8; of Maestricht, allies and French, Sept. 18; of Clermont, Sept. 20; of Piedmont, Sept. 23; of Posnania, Prussians and Poles, Sept. 24; of Milan, Sardinians and French, Sept. 31; of Emmerick, allies and French, Oct. 2; of Warsaw, in which the Prussians totally defeat the Poles, Oct. 12; of Druten, English and French, Oct. 20; of Pampeluna, Spaniards and French, Oct. 28; of Nimeguen, allies and French, Nov. 4; of Sendomir, Poles and Prussians, &c. Nov. 16; of Navarre, Spaniards and French, Nov. 25; of Mentz, allies and French, Dec. 1. The French take Bergen-op-Zoom, Bois-le-duc, Breda, and Brussels taken. The French take Charleroi, June 26; Cleves and Landrecy, July 15. St Lucia taken by the English. The French take Maestricht, Nov. 4. Namur, by the French, July 13, and Treves. Telegraphs, invented in 1687, used by the French this year. Lord Howe defeats the French fleet, and takes 6 ships of war, June

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1. Craton surrendered to the Prussians, June 15. Dieppe burned by the English, July 14. Martinique taken from the French, March 23. Earthquake in Turkey, July 3, which destroyed three towns containing 10,000 inhabitants; also near Naples, June 13, which almost destroyed the city of Torre-del-Greco. About 3000 persons killed at Grenelle, near Paris, by an explosion of powder mills, Sept. 3. Lavoisier, ob. æt. 51. Sir W. Jones, ob. æt. 48. M. de Condorcet, ob. æt. 51. Ed. Gibbon, ob. æt. 57.

1795. A large meteoric stone fell near Wood Cottage in Yorkshire, weighing 55 pounds, Dec. 13. Louis XVII. of France dies in prison, June 8. Telegraphs used by the English, June 26. French take possession of Amsterdam, Jan. 18. Stadtholder obliged to retire to England. Warren Hastings, after a trial of 7 years, acquitted April 23. Battle on the Waal, allies and French, Jan. 11; of Catalonia, March 5; of Neve Munster, March 5 and 18; of Figuera, Spaniards defeated, April 5; of Piedmont, Piedmontese defeated, April 12; of Pontas in Catalonia, French defeated, June 14; of Piedmont, French defeated, June 24, 27, and July 1; of Pampeluna, French defeated, July 9; of Bilboa, Spaniards defeated, July 17; of Quiberon, emigrants defeated, July 21; of Urutia, French defeated, July 30; of Vittoria, Spaniards defeated, Aug. 14; of Piedmont, Austrians defeated, Aug. 20; of La Pietra, French defeated, Aug. 31; on the Lahn, French defeated, Sept. 19; of Manheim, Austrians defeated, Sept. 23; French defeated at Piedmont, Oct. 1; on the Mayne, Oct. 11; at Mentz, Oct. 29; at Worms, Nov. 8; at Moselle, Nov. 22; at Deux Ponts, Nov. 28; and at Alsentz, Dec. 8. Breda taken by the French. Briel seized by them in January. The English take the Cape of Good Hope in June. The French take Dort, Jan. 10, and Dusseldorf, Sept. 6. Frankendal retaken from the French, Nov. 12. Luxembourg surrenders to the French, June 7. Malacca surrenders to the English, Aug. 17. Manheim retaken by the Austrians, with 10,338 prisoners and 4 generals, Nov. 23. Sir E. Pellew takes 15 sail, and burns 7, out of a fleet of 35 sail of transports, March 8. Admiral Hotham defeats the French fleet, and takes two ships of war, March 14. The Sceptre man of war takes 11 Dutch East Indiamen, June 19. Lord Bridport defeats the French fleet, June 25. Trincomalee taken by the English. The French take Utrecht, Jan. 18. Poland partitioned between Russia, Austria, and Prussia, Nov. 25. Peace between France and Prussia, and between France and Spain. The arsenal, admiralty, &c. with nearly 50 streets in Copenhagen, destroyed by fire, June 5. A dreadful eruption of Mount Vesuvius. A comet appears; see Astronomy, p. 816.

1796. A meteoric stone, of 10 pounds weight, fell in Portugal, on the 19th Feb. On the 8th March, a meteoric stone fell in Luzatia. Bamberg taken by the French, Aug. 4. The Sardinians defeated by the French at the battle of Piedmont, April 14. Battle of Lodi, French and Austrians, May 11; of Mantua, May 29; of Wetzlaer, French defeated, June 4; near Kirpen, French defeated, June 20. Austrians defeated by Jourdan, July 6; Archduke repulsed by the French, July 8. Siege of Mantua raised, July 23. Austrians defeated by Jourdan, Aug. 11. Jourdan defeated by the archduke near Nuremberg, Aug. 18. French defeated by the Austrians, near Neuwied and Amberg, Aug. 24. Jourdan defeated near Munich, Sept. 11; near Limberg, Sept. 18; and at Ishy on the Leck, Sept. 19. The French take Bengau, Aug. 17. Bonaparte seizes Egypt, July 1. Columbo surrenders to the English, June 12. Constance seized by the French, Aug. 2. Demerara, &c. surrendered to the English, April 23; and again Sept. 23, 1803. The French take Florence, July; Franckfort, July; Goza, June 11; and Milan, May 18. Minorca surrenders to the English, Nov. 14. The French take Munich, Aug. 25; and Nuremberg, July 9. Sir G. K. Elphinstone takes the Dutch fleet in Saldanna Bay, Aug. 19. Peace between France and Naples; the French and Sardinians; England and Spain. Catherine II. of Russia dies, Nov. 10. A comet appears; see Astronomy, p. 816. Amboyna seized by the English, Nov. 28. Dr Thomas Reid, ob. æt. 87. Dr G. Campbell, ob. Anton. Ulloa, ob. æt. 80. James Macpherson, ob. æt. 58.

1797. Bank of England refuse to pay in specie, Feb. 25. The French invade Ireland. Mutiny on board the fleet at Portsmouth for advance of wages, &c. April 18, which subsided May 10. Mutiny at the Nore, which was quelled June 10, when several of the mutineers were executed. Revolution in Venice, May 17. Battle between the Austrians and Bonaparte in Italy, Jan. 19. and 27, when the Austrians were defeated. Bonaparte defeats the Archduke, April 1. The Austrians again defeated on the Upper Rhine, May 7, when the French take Frankfort, Kehl, &c. The French land a small force in South Wales, Feb. 22. Ireland put under martial law, May 19. The Spanish fleet defeated by Sir J. Jervis, who takes four ships of war, Feb. 14. Admiral Duncan defeats the Dutch fleet off Camperdown, when two admirals and fifteen ships of war were captured or destroyed, Oct. 11. Trinidad and four ships of the line taken by the English. Trieste seized by the French, but retaken by the Austrians, April 14. Verona taken by the French, April 28. The republic of Venice abolished by the French. Treaty of Campo Formio, between the French and Austrians, signed Oct. 17. Newspapers first published at Constantinople. An earthquake at Sumatra, by which about 300 persons perished, Feb. 20. The country between Santa Fé and Panama, and the cities of Cuzco and Quito, with 40,000 inhabitants, destroyed by an earthquake in February: Violent shocks were also felt in the West Indies. St Domingo declares itself independent in January. The French seize the Tyrol. A comet appears; see Astronomy, p. 816. W. Mason, ob. æt. 72. Dr James Hutton, ob.

1798. A meteoric stone, weighing 20 pounds, fell in the department of the Rhone, on the 12th March. Other meteoric stones, one of which weighed 26 pounds, fell in India, at Krakhest, on the north side of the river Goomty, on the 19th Dec. Louis XVIII. retires to Petersburg, April 3. The pope leaves Rome, which is taken possession of by the French, Feb. 26. Rome declared itself an independent republic. The pope dies a captive, Sept. 1799. The French take Alexandria. Alessandria surrenders to the Austrians and Russians, July 24, 1799. The French take Malta, July 11. The Swiss troops defeated by the French, and their independency abolished, Sept. 19. Battle between the Irish rebels and the king's forces, at Kilcullen, May 22. Battle in Connaught, where the French aided the Irish rebels, and were all taken prisoners, Sept. 7. The English destroy the basons, gates, and sluices of the canal at Bruges, May 19. The French seize Genoa. The French land at Killala Bay, Aug. 22, 1500 men, who surrender on Sept. 7. Piedmont surrendered to the French, Dec. 6. Naval battle of Aboukir, in which the French fleet of 17 sail of the line is totally defeated, and nine of them taken, by Sir H. Nelson, Aug. 1. Sir J. B. Warren defeats a French fleet of nine sail off the coast of Ireland, and takes five of them, Oct. 12. War between France, Naples, and Sardinia, Nov. Earthquake at Sienna, by which 50 persons perished, May 25. The Turks declare war against France. Two comets appear; see ASTRONOMY, p. 816. T. Pennant, ob. æt. 72.

1799. Corsica relinquished. Ancona surrenders to the Imperialists, Nov. 13. Battle between the French and Neapolitans near Naples, Jan. 18. The archduke Charles defeats the French, and takes 2000 prisoners, March 14, 26, near Stockach. The French defeated near Verona, March 5, 25, and 26; and on the 30th, and April 5. The French defeated by the Austrians, April 19. and 20, near Cremona; by the Russians near Milan, April 27, 11,000 killed and taken prisoners; near Cassano, April 27. Bonaparte is repulsed at Acre by the Turks and Sir Sidney Smith, April 16; defeated near the Adda, March 26, 31, and May 5; defeated by Suwarrow near Alessandria, May 17; defeated at Zurich, with the loss of 4000 men, June 4; by Suwarrow, June 19, when the French lost 18,268 men. Tippoo Saib defeated and slain near Periapatam in the East Indies by the English forces, May 4. Massena defeats the Austrians near Coire, May 7. The archduke defeats Jourdan, April 2. Kray defeats the French under Scherer in Italy, April 18. Suwarrow defeats the French at the passage of the Adda, May 23. Bonaparte defeated before Acre by Sir Sidney Smith, May 27. Cardinal Ruffo defeats the French at Naples, June 5. Suwarrow defeats Macdonald near Parma, with the loss of 10,000 men and four generals, July 12; Moreau, July 18; and Joubert, who was slain at Novi, Aug. 15, along with 10,000 killed. The French defeated near Tranto, June 19; near Manheim, Aug. 12. The Imperialists defeated near Zurich, Sept. 21. The French defeated near Mendovi, Nov. 6; near Philipsburgh, with the loss of 4000 men, Dec. 3; near Coni, which surrenders to the Austrians, Dec. 4. The Austrians defeated near Genoa, Dec. 12. Corfu taken by the Russians, Mar. 3. St Elmo surrenders to the Neapolitans, July 12. Capua surrenders to the allies, July 26. Mantua retaken by the Russians, July 28. The French take Naples, June 21; which is retaken by Cardinal Ruffo, July 10. The Dutch fleet in the Texel surrenders to Admiral Mitchell, Aug. 29. Tortona taken by the French, July 5; and surrendered to the Imperialists, Aug. 11. Citadel of Turin surrenders, May 17. Urbino surrendered to the Austrians, July 10. Holland invaded by the English, Aug. 27; abandoned by a convention, Oct. 19. Meteoric stones fell on the 5th April, near Batanrouge, on the Mississippi. Two comets appear; see ASTRONOMY, p. 816. Ch. Borda, ob. æt. 64. L. Galvani, ob. æt. 55. Marmontel, ob. L. Spallanzani, ob.

1800. Bonaparte's life attempted by an explosion of combustibles, Dec. 24. Battle of Novi, Austrians and French, Jan. 8; of Savona, in Italy, April 8; of Veragio, April 10, the French defeated; of Stockach, May 1, the Austrians defeated; of Moskirch, May 3, ditto; of Marengo, 6000 Austrians killed, and 8000 prisoners taken, June 21; of Hohenlinden, Austrians defeated, Nov. 3; on the Mincio, Dec. 25, Austrians defeated. Genoa taken by the English and Austrians in May, and surrendered to the French in July. The French seize Tuscany. Union act for Ireland passed, July 2. Batavia taken by the English, Sept. 12. Earthquake at Constantinople, Oct. 24. Curaçoa taken by the English, Sept. 14. Inundation at St Domingo, which destroyed 1400 persons, Oct. Northern confederacy against England. W. Cowper, ob. æt. 69. Dr Jos. Black, ob. æt. 73.

NINETEENTH CENTURY.

1801. Jan. 1. Planet Ceres discovered by Piazzi. Union with Ireland carried into effect, Jan. 1. Aboukir surrenders to the English, Mar. 18. French defeated by the English at the battle of Rhamonia, in Egypt, March. 21. Cairo taken by the English and Turks, June 21. Madeira surrenders to the English, July 25. Naples occupied by the French, April 8. Lord Nelson takes and destroys the Danish fleet of 28 sail off Copenhagen, Sept. 2. Defeat of the French fleet near Cadiz, in which two 74's are burnt and one taken, July 16. Peace between France and Austria, Feb. 9. War between Portugal and Spain, Feb. 28. Peace between France and Naples, March; between Spain and Portugal, June 10; between France and Portugal, Sept. 29. The English take Alexandria, Aug. 22. War between France and Turkey, Oct. 17. The Danish island St Bartholomew taken by the English, March 20. The first imperial parliament in England held in January. Northern confederacy against England dissolved by a British fleet. The Danish island St Martins taken by the English, Mar. 24. Dolomieu, ob. A comet appears; see ASTRONOMY, p. 816.

1802. Sir R. Abercromby defeats the French before

Alexandria, Mar. 21, and died a few days after of his wounds. Peace between England, France, Spain, and Holland, Mar. 27. The planet Pallas discovered by Olbers, Mar. 28. Foundation stone of the London Docks laid, June 26. West India Docks opened, Aug. 21. Crema, in Upper Hungary, nearly destroyed by an earthquake, June 12. Stockholm nearly destroyed by fire, Nov. 15. Stadtholder of Holland renounced by the Prince of Orange, in a treaty with France, July. Life-boats invented by Mr Greathead, who was rewarded by parliament in May. A comet appears; see Astronomy, p. 816. Dr Darwin, ob.

1803. About 3000 meteoric stones, the largest of which weighed 17 pounds, fell at Aigle, in France, on the 26th of April. On the 5th of October, another shower of stones fell at Avignon. On the 13th December, another shower of stones fell at Messing, in Bohemia. All the British in France detained prisoners of war in May. Bonaparte makes offers to Louis XVIII. to induce him to relinquish the crown in his favour, Feb. 26. War between England and France. Scindiah defeated by the English, Aug. 11. Demerara surrenders to the English, Sept. 23. The French take Lubec, June. The English take Tobago, June 30. Hanover occupied by the French, June 14. A brilliant meteor, which rendered legible the writing on the signs at London, appeared at half-past-eight in the evening, Nov. 18. Dr Beattie, ob. æt. 68.

1804. A large meteoric stone fell at Possil, near Glasgow, on the 5th April. Another meteoric stone fell at Apt, in the department of Vaucluse, on the 6th October. France formed into an empire, May 5, and Napoleon Bonaparte crowned emperor, Dec. 2. A fleet of Indiamen, under Captain Dance, drives off a squadron of French ships of the line, Feb. 15. Goree taken by the English, Mar. 9. Earthquake in Holland, which makes the chandeliers in Maaslin church vibrate two or three feet, January. The Emperor of Germany assumes the title of Emperor of Austria, Aug. 11. War between England and Spain, Dec. 14. The planet Juno discovered by Mr Harding, Sept. 1. A comet appears; see Astronomy, p. 816. Dr Priestly, ob. æt. 71.

1805. Letters of marque issued against Spain, Jan. 11. The London Wet Docks opened, Jan. 31. A French squadron from Rochfort levied contributions on some of the West India islands. Feb. 21. Bonaparte assumes the title of King of Italy, Mar. 18. Holkar defeated by the English at the battle of Bhurtpore, April 2. Schimmelpenninck made Grand Pensionary of the Dutch government, May 1. The Ligurian republic united with France, May 25. Lord Melville impeached, June 26. Meteoric stones fell in one of the squares of Constantinople, in the month of June. Treaty between France and Naples ratified at Portici, Oct. 8. Marquis Cornwallis dies at Ghauzepore, Oct. 5, æt. 67. Battle of Guntzburg, in which the French defeat the Austrians, Oct. 2. Battle of Ulm, in which the French take the Austrians prisoners, Oct. 19. Ulm surrendered by General Mack with 30,000 men. The French defeat the Austrians at Moelk, Nov. 10; at Loeben, Nov. 13; and at Diernstein, Nov. 14. The French take Vienna, Nov. 13. The imperial palace of Schoenbrunn taken by the French, Nov. 14. Presburg taken by the French, Nov. 15. Battle of Tinterdorff, in which the French beat the Austrians and Russians, Nov. 16. Battle of Austerlitz, in which the Austrians and Russians are completely defeated by the French, Dec. 2. Sir Robert Calder captures two sail of Spanish ships, after an engagement of four hours with the combined fleet off Ferrol. Battle of Trafalgar, in which Lord Nelson was killed, after having nearly taken and destroyed the combined fleets of France and Spain, Oct. 21. Sir R. Strachan takes four French ships of the line off Cape Ortegal, Nov. 4. Treaty of Presburg, between France and Austria, Dec. 27. Treaty concluded with Scindiah by General Lake, Nov. 22. Peace with Holkar, Dec. 24. An earthquake at Eisenhartz, in Styria, July 24. An earthquake at Naples and its vicinity, in which 20,000 lives are lost, July 26. A shock of an earthquake felt in many parts of Rome, July 30. Two comets appear; see Astronomy, p. 816.

1806. Hanover occupied by the Prussians. Admiral Duckworth took and destroyed five French ships of the line in the bay of St Domingo. Public funeral of the Right Hon. William Pitt, (who died Jan. 23), Feb. 22. Two meteoric stones fell at Etienne and Valence, on the 15th of March. French squadron under Linois captured on its return from India, by Sir J. B. Warren, March 13. Prince of Orange dies, April 22. Trial of Lord Melville commences in Westminster-hall, April 29. The island of Capri taken by Sir Sidney Smith, April 22. A meteoric stone falls at Basingstoke, Hants, on the 17th May. Louis Bonaparte proclaimed King of Holland, at St Cloud, Paris, June 5. A resolution for the abolishing of the slave trade adopted, on the motion of Mr Fox, in the House of Commons, June 10. A similar resolution adopted, on the motion of Lord Grenville, in the House of Lords, June 24. Lord Melville acquitted, June 12. The brilliant victory of Maida gained by Sir John Stuart, over Gen. Regnier. Confederation of the Rhine established. July 12. Gæta taken by the French, July 13. Peace between France and Russia, signed at Paris, by M. d'Oubril, the Russian ambassador, but not ratified by the Emperor of Russia, Aug. 13. Surrender of Buenos Ayres, &c. to Major General Beresford and Sir Home Popham, July 28. Francis II. resigns the office of Emperor of Germany, Aug. 7. A manifesto against the government of France, published by the Emperor of Russia, Aug. 30. A tremendous hurricane at Dominico and Martinico, Sept. 9. Mr Fox died, Sept. 13. Sir Samuel Hood, with the Centaur and Monarch, captures four French frigates. Hostilities between the French and Prussians begin, by a skirmish near the bridge of Saalfeld, where Prince Ferdinand Louis of

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Prussia was slain, Oct. 10. Battle of Jena, between the French and Prussians, in which the latter were defeated with immense loss, Oct. 14. Surrender of the corps of the Prussian army, under Prince Hohenloe, to the French under Murat, Oct. 21; the French take possession of Stettin and Custrin. A proclamation of Bonaparte, offering independence to the Poles, Nov. 3. The Electors of Saxony and Hesse accede to the Confederation of the Rhine, Nov. 6. The Prussian corps, under Blucher, capitulate to the French, after a brave and skilful retreat, Nov. 7. The French take Magdeburg, Nov. 7. The Duke of Brunswick dies, near Altona, of a wound received in the battle of Jena, Nov. 9. The French cross the Vistula, and occupy Prague, Dec. 5. Surrender of Thorn, Graudentz, Warsaw, &c. Poland proclaimed independent. War between Russia and Turkey. Battle of Pultusk, Oct. 26. A comet appears; see ASTRONOMY, p. 816.

1807. Monte Video taken by the British, Feb. 9. Battle of Eylau between the French and Russians, Feb 17. Unsuccessful expedition to the Dardanelles, Feb. 19. A meteoric stone of 160 pounds weight, fell in the circle of Ichnow, in the government of Smolensko, on the 13th March. The planet Vesta was discovered by Dr Olbers, on the 29th March. The British army repulsed at Rosetta, April 4, and 24. Russians defeated by the French at the battle of Friedland, June 14. Peace of Tilsit, between France and Russia, signed June 25. Heligoland taken by the British, July 4. The Spaniards repulse the British troops under Gen. Whitelocke, at Buenos Ayres, July 6. Bombardment of Copenhagen, and the surrender of the Danish fleet, Sept. 7. The Prince Regent of Portugal, accompanied by the royal family, abandons his kingdom in consequence of the advance of the French under Junot, and sails for the Brazils, Nov. 29. An embargo laid on American vessels in their own harbours, Dec. 7. Several meteoric stones, weighing from 25, 30, and 200 pounds, fell in the province of Connecticut, on the 14th Dec.

1808. The French obtain possession of Rome, Feb. 2. War between Russia and Sweden begins, Feb. 24. Christian VII. of Denmark dies, March 13, and is succeeded by his son Frederick. King Charles abdicates the Spanish throne in favour of his son Ferdinand VII. March 19. The French army, commanded by Murat, enters Madrid, March 23. The royal family of Spain arrive at Bayonne, April 24. The King of Spain abdicates his crown in favour of Bonaparte, May 5. Ferdinand VII. signs a renunciation of the Spanish crown, May 12. The royal family of Spain sent from Bayonne into the interior of France, May 13. Solano, the governor of Cadiz, murdered by the populace, May 20. Meteoric stones, weighing 4 and 5 pounds, fell near Stannern, a post station in Moravia, on the 22d May. Two Spanish deputies arrive in England to supplicate aid to the Spanish patriots, June 9. The French fleet at Cadiz surrenders to the Spaniards, June 14. Siege of Zaragoza, June 14. Joseph Bonaparte proclaimed King of Spain at Bayonne, June 16. A British army, of 12,000 men, under Sir A. Wellesley, sails for Portugal from Cork, July 12. The French defeat the Spaniards at Rio Seco, July 14. The French army under General Dupont surrenders to the Spaniards, July 20th. Revolution in Turkey, in which Mustapha is defeated, July 28th. British army arrives in Spain, Aug. 1, and defeats the French at the battle of Roleia, Aug. 17; and at the battle of Vimiera, Aug. 21. Ferdinand VII. proclaimed King of Spain at Madrid, Aug. 24. Convention of Cintra, which excites the greatest indignation in England, Aug. 30. A French army under Marshal Ney enters Spain, Sept. 3. A meteoric stone fell at Lissa, in Bohemia, on the 3d September. A Spanish army of 10,000 men, under the Marquis de Romana, escapes from Nyborg in Denmark, Aug. 11; and lands at Corunna, Sept. 30. Bonaparte meets the Emperor of Russia at Erfurth, Sept. 27. The Spanish armies under Blake and Castanos defeated by the French, Nov. 10. and 23. Madrid occupied by the French, Dec. 4.

1809. Peace between Britain and Turkey, Jan. 5. Battle of Corunna, at which the French were defeated, and Sir John Moore killed, Jan. 16. Duke of York accused of malversation, Feb. 1, and resigns the office of commander in chief, March 10. Drury-lane theatre burnt, Feb. 24. Surrender of Zaragoza, March 5. Revolution in Sweden, and Gustavus IV. deposed, March 13. Austria declares war upon France, April 6. Lord Cochrane destroys the French fleet in Basque Roads, April 12. The French defeat the Austrians in the battles of Abensberg, Ratisbon, and Eckmuhl, April 20—23. Sir A. Wellesley defeats the French at Oporto, May 11. The French obtain possession of Vienna, May 13. Battle of Aspern, or Esling, between the French and Austrians, in which the Austrians had 20,602 killed and wounded, May 21. Schill, the celebrated Prussian officer, killed in Stralsund, May 31. The Austrians completely defeated by the French at the battle of Wagram, July 5, 6. Suspension of hostilities between France and Austria, July 12. Surrender of Senegal to the British, July 20. Battle of Talavera between the British and French, July 27. The British troops, after landing in Walcheren, July 30, take Middleburg, July 31; and Flushing, Aug. 15. Peace between Russia and Sweden signed, Sept. 17. Peace between France and Austria ratified, Oct. 15. The 50th anniversary of the King's accession celebrated in every part of the kingdom, Oct. 25. Lord Collingwood destroys 3 French ships of the line bound from Toulon to Barcelona, off Cape St Sebastian, Oct. 25. Bonaparte divorces his wife the Empress Josephine, Dec. 16.

1810. Bonaparte relaxes the Berlin and Milan decrees, Jan. 4. A shower of meteoric stones fell in Caswell county, North America, Jan 30. An earthquake at Malta, Feb. 16. Amboyna and its dependencies surrender to the British, Feb.

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17. Guadaloupe taken by the British, March 5. Lord Collingwood dies, March 7. Bonaparte marries the Princess Maria Louisa, daughter of the Emperor of Austria, April 1. Great riots in London, on the committal of Sir F. Burdett to the Tower, April 9. Crown Prince of Sweden dies, April 29. American non-intercourse act repealed, May 1. Mr Windham dies, June 4. Riot in Stockholm, at the funeral of the Crown Prince, June 20. Louis Bonaparte abdicates the throne of Holland, July 1. The Isle of Bourbon surrenders to the British, July 8. Holland annexed to the French empire, July 9. Ciudad Rodrigo taken by the French, July 10. A meteoric stone, weighing 7¾ pounds, fell in the county of Tipperary, Ireland, Aug. 10. An earthquake felt at St Michael's, one of the Azores, Aug. 12. Bernadotte chosen Crown Prince of Sweden, Aug. 21. A small comet discovered by M. Pons, 22d Aug. Lucien Bonaparte and his family taken by the Pomona frigate, Aug. 23. Almeyda surrenders to the French, Aug. 28. A great eruption of Mount Vesuvius, Sept. 10. Bonaparte issues a decree to burn all British merchandize, Oct. 19. Princess Amelia dies, Nov. 2. Gustavus Adolphus, the late King of Sweden, arrives at Yarmouth, Nov. 10. Three meteoric stones fell in the department of the Loiret, Nov. 23. Henry Cavendish, ob. æt. 78.

1811. Tortosa surrenders to the French, Jan. 1. Prince of Wales appointed Regent, Feb. 4. A meteoric stone, of 15 pounds, fell in the village of Konleghowsk, in the government of Tschernigoff, in Russia, on the 1st March. Battle of Barrosa, in which the French are defeated by the British under General Graham, March 5. Anholt defended by a handful of British sailors against the Danish flotilla, of 18 gun boats, and 4000 men. Badajos surrenders to the French, March 10. A small comet discovered by Flauguergues, 25th March. The French defeated by Lord Wellington in the battle of Fuentes de Honores, May 5th. General Beresford defeats the French under Soult in the battle of Albuera, May 16th. Action between the American frigate the President of 44 guns, commanded by commodore Rogers, and the British vessel the Little Belt of 18 guns, May 16th. Siege of Badajos raised, June 11th. Marshal Suchet takes Tarragona by assault, June 29th, and makes himself master of Montserrat, July 24th. The settlement of Batavia, the last colony of France, surrenders to the British under Sir Samuel Auchmuty, September 17th. The Boulogne flotilla defeated by the Naiad frigate in the presence of Bonaparte, Sept. 22d. General Blake defeated by the French under Suchet, Oct. 25. In consequence of this victory Murviedro surrenders to the French, Oct. 27th. General Hill surprises and routs the division of general Girard, Oct. 28th. A comet appears, Dec. 23d. The St George of 98 guns, and the Defence of 74 guns, stranded on the coast of Jutland, and the whole of the crews, amounting to 2100 men, perished, Oct. 24. The Hero of 74 guns stranded on a sand bank off the Texel, and the whole of her crew lost, Dec. 25th. General Blake defeated by the French near Valencia, Dec. 26th.

1812. The French defeated at Tariffa by colonel Skerret, Jan. 1st. Lord Wellington takes Ciudad Rodrigo by storm, Jan. 19th. Valencia surrenders to the French, along with the army under General Blake, Feb. 6th. A dreadful earthquake in the Caraccas, March 26th. Bonaparte makes proposals for peace, which are rejected, April 17th. Badajos taken by Lord Wellington, April 27th. Bonaparte sets out from Paris, to take the command of the army against Russia, May 9th. Mr Perceval shot in the lobby of the House of Commons, May 11th. America declares war against Britain, June 18th. Joseph Bonaparte evacuates Madrid, June 28th. Lord Wellington defeats the French under Marmont, near Salamanca. Preliminaries of peace signed between Britain, Russia, and Sweden. Orders in council revoked, June 23d. Revolution in Sicily, July 20th. Lord Wellington enters Madrid, Aug. 12. Marshal Victor besieges Riga, Aug. 13th. General Hull and the American army taken prisoners by General Brock, Aug. 17. Battle of Smolensko, between the French and Russians, Aug. 16. Battle of Mojaisk, in which the victory is claimed both by the French and Russians, Sept. 7. Soult raises the siege of Cadiz, Aug. 25th. A great and sanguinary battle fought at Borrodino, between the French and Russians, in which the victory is claimed by both sides, Sept. 7. The Russians burn Moscow, which the French enter, Sept. 14. Lord Wellington advances to Burgos, Sept. 21st. The French evacuate Moscow, and begin a disastrous retreat, Oct. 19th. Lord Wellington raises the siege of Burgos, Oct. 20th. Moscow re-occupied by the Russians, Oct. 22d. Bonaparte, after leaving his army at Smorgony on the 25th Nov. arrives in Paris on the 18th Dec. The French defeated at the passage of the Beresina, Nov. 28th. Wilna taken by the Russians, Dec. 10. Thirty thousand Prussians under General York join the Russian army, Dec. 30.

1813. The Conservative Senate of France agree to place 350,000 men at the disposal of the Minister of War, Jan. 11th. The House of Commons agree, by a majority of 40, in a House of 488, to go into a committee on the Catholic question, Mar. 2. The Russians enter Hamburg, Mar. 8, and Berlin, Mar. 10. The Russians defeat the French at Lunenburg under Morand, who is slain, April 2. Sir John Murray defeats the French under Suchet, at Castello, in Spain, April 13. Thorn surrenders to the Russians, April 16, and Spandau on the 18th April. Battle of Lutzen, in which the victory is claimed both by the French and the allies, May 2. The Roman Catholic bill lost at its third reading in the House of Commons, by a majority of four, May 24.

CHRONOMETER. See Timekeeper.

CHRONOMETER, in Music, an instrument for accurately measuring time. Of these, two different kinds are in use with musicians. One of them is for measuring the equal spaces of time, in which the bars and principal notes in any given piece of music are to be performed, in place of the signals of the coryphæus, mesochori, or manuductor of the ancients, and the motions of the maestro di capella, conductore, or leader of our modern performances, or concerts. The late Dr Robinson, in the *British Magazine*, vol. ii. p. 283, proposed the use of a graduated pendulum, for marking the lengths of the notes in performance, and gave a table of the lengths of pendulums for the notes of several of the most popular of Handel's songs, &c. The late Mr Clagget, and since him Mr Peck of Lombard street, sold a machine for *beating time*, as it is called among singers. The other kind of chronometer is useful to tuners of organs and piano fortes, being calculated, according to the suggestion of the late Dr Robert Smith, in his *Harmonics*, 2d edit. p. 210, to measure fractions of a quarter of a minute, or of one second in other machines, according to the calculated velocity of the Beats (see that article) of any particular system of temperament that is wished to be tuned. A simple, accurate, and general *beat-counter*, is still, however, a great desideratum with the tuners of organs, piano-fortes, harps, &c. (ε)

CHRYSANTHELLUM, a genus of plants of the class Syngenesia, and order Polygamia Superflua. See Botany, p. 311.

CHRYSANTHEMUM, a genus of plants of the class Syngenesia, and order Polygamia Superflua. See Botany, p. 300.

CHRYSITRIX, a genus of plants of the class Polygamia, and order Diœcia. See Botany, p. 346.

CHRYSOBALANUS, a genus of plants of the class Icosandria, and order Monogynia. See Botany, p. 229.

CHRYSOBERYL. See Oryctognosy.

CHRYSOCOMA, a genus of plants of the class Syngenesia, and order Polygamia Æqualis. See Botany, p. 296.

CHRYSOLITE. See Oryctognosy.

CHRYSOMELA. See Entomology.

CHRYSOPHYLLUM, a genus of plants of the class Pentandria, and order Monogynia. See Botany, p. 146.

CHRYSOPLENIUM, a genus of plants of the class Decandria, and order Monogynia. See Botany, page 214.

CHRYSOPRASE. See Oryctognosy.

CHUKA or Chooka. See Thibet.

CHUNCHOA, a genus of plants of the class Decandria, and order Monogynia. See Botany, p. 222.

CHURCH History. See Ecclesiastical History.

CHURCHILL, John, Duke of Marlborough, the most successful general in English history, was the son of Sir Winston Churchill, and was born at Ashe in Devonshire in 1650. The course of his early education has not been accurately recorded, and it is probable, that he had acquired little beyond the elements of learning, when his father was induced to carry him, at the early age of twelve, to court. The hereditary loyalty of the family seemed to have paved the way for the appointment of young Churchill to those stations of which his years admitted, as he soon became a page to the Duke of York, and an ensign in the guards. His farther advancement was promoted by his comely person, his prepossessing manners, and, by a circumstance of less credit to his family, we mean, that of his sister being mistress to the Duke of York. She was the mother of the celebrated Duke of Berwick. Churchill's first opportunities of acquiring military knowledge were in the service of France, in which, in consequence of King Charles's unnatural alliance in 1672, a body of English auxiliaries served under command of the king's natural son, the Duke of Monmouth. Churchill was then a captain, and distinguished himself by many acts of bravery. Turenne was commander in chief, and young as Churchill was, it is probable that the tactics of that distinguished leader furnished him with much matter of reflection. Being equally in favour with the Duke of Monmouth and the Duke of York, he attained, before the end of the war, the rank of lieutenant-colonel. After the peace of Nimeguen, his official duties kept him a great deal about court; and though he was thought somewhat too free a speaker for that situation, he contrived to pass through those years of disquietude and civil dissension without committing himself with either party. His station was with the Duke of York; but, dependant as he was on his Royal Highness, he never thought of courting his favour by condescension on the score of religion.

In the year 1681 he became a married man, by espousing Miss Sarah Jennings, one of the maids of honour to the Princess Anne. Miss Jennings was then about 21, highly beautiful, and in great favour with her young mistress. Appearances thus seemed to promise much advantage from the match; and it is certain that Marlborough's ascendency over our councils in the early part of Queen Anne's reign, might have been less complete without the influence of his wife. But, on the other hand, we cannot help thinking it, on the whole, matter of regret, that he interfered at all with the business of the court. Had he confined himself strictly to his profession, his country might have had equal benefit from his services, and his character might have been free from the serious charge of wilfully prolonging the war. Certain it is, that his unfortunate failing, the love of money, was greatly aggravated by his wife's disposition; for several of those acts which drew odium upon him, proceeded evidently from her interference. In 1681, he obtained a regiment of dragoons, and was next year created Baron of Eymouth in Scotland. On James's accession in 1685, he was sent over on a short mission to France, and made an English peer by the title of Baron Churchill. He appears to have acted a prudent part during the three years of this infatuated reign, adhering to his own principles, and taking no share in the king's obnoxious acts. He was one of those, who sent over early an assurance of attachment to the Prince of Orange, and took an opportunity of joining him soon after he landed. On this occasion he thought proper to leave a letter to King James, lamenting the necessity of the step, ascribing it to the imperious dictates of conscience, and repeating, in the strongest terms, his attachment to the king personally.

After William's accession to the crown, Churchill was for some time in favour, being raised to the dignity of Earl of Marlborough, and entrusted, when William was in Ireland, with the command of the British auxiliaries in Flanders. It was in this summer, at the battle of Walcourt, that Marlborough first taught the French what they were to expect in future from his talents. Prince Waldeck, the commander in chief, declared, that "Marlborough saw more into the art of war in a day, than some generals in a course of years." Next year he distinguished himself in Ireland by the capture of Cork and Kinsale; acquisitions which tended to accelerate the conclusion of that miserable war. The year after 1691, he served under King William on the continent; but early in 1692 he was subjected to a very sudden loss of favour, his several offices being taken from him and given to others. His dismissal was followed by a still stronger measure, that of his commitment to the Tower, from which he was not released for several months. No public charge was brought against him, and the matter is still involved in uncertainty. Before this time differences had arisen between Queen Mary and her sister the Princess Anne. The Earl and Countess of Marlborough being attached to the latter, were sharers in her loss of court favour. King William had been elevated, in the fervour of the Revolution, to the utter exclusion of James's son; a step considerably beyond the calculations of those who called him over from Holland, and not rendered acceptable by any thing inviting or pleasant in William's manner. His confidence and his favour seemed to centre in foreigners, while English officers and noblemen were kept at a great distance. Sympathy for the fallen king operated in concurrence with these circumstances; and we accordingly find from Dalrymple and Macpherson's State Papers, that a secret correspondence was carried on by Godolphin, Russel, Marlborough, and other men of consequence, with the court of St Germains. To some discovery of this nature, was probably owing the disgrace of Marlborough. That family pique entered likewise into it is apparent, from the circumstance of an approximation between him and King William after the death of Queen Mary. It was evidently William's policy to be in good terms with a person so dear to the Princess Anne; but it is farther apparent, from the confidential business entrusted to Marlborough in the last three years of his reign, that all distrust of him was banished from his mind. At the approach of death, William, with whom opposition to France was always uppermost, recommended Marlborough as the most proper person to be entrusted with the command of the army destined to protect the liberty of Europe.

We are now arrived at the memorable æra in Marlborough's life, when the command of the allied forces, and the management of our foreign alliances, were vested in his person. This took place in the beginning of 1702, when he was in his 52d year, possessing the full advantage of matured experience, without any loss of constitutional activity. The unlimited favour of the queen, and the confidence of the allies, speedily acquired by engaging manners and brilliant successs, soon gave him a more complete controul over the military engine which he wielded than is common in a war of coalition. All this, however, was requisite; for France, flushed with former triumphs and recent acquisitions, was on the point of giving law to Europe. Louis XIV. had reigned forty years, and conducted three great wars, in the course of which the French armies had received hardly a single overthrow. At first he appeared to consider the campaign on the Dutch frontiers as a secondary part of the war, but Marlborough's progress soon taught him to view it in a different light. Had not the caution of the Dutch been opposed to offensive operations, there can be little doubt that the Duke, instead of merely taking fortified towns, and obliging the French to keep on the defensive during 1702 and 1703, would have accelerated the progress of the war, and inflicted on them a signal overthrow. It was not till 1704 that the Duke, being allowed to take the allied troops into Germany, and being consequently removed from unwise controul, shone forth in the true lustre of his talents. In that campaign he co-operated with Prince Eugene, with whom his uninterrupted cordiality is a circumstance highly honourable to both, and not often exemplified in military history. The victory of Blenheim was the first fruits of their harmony, and accomplished the deliverance of the emperor from imminent danger. Next year, Marlborough advanced towards the Moselle, on the plan of carrying on the war in the open country of Lorraine, and avoiding the delay inseparable from a succession of sieges. But this bold and judicious scheme was thwarted by the incurable slowness of the Germans, who failed in all their engagements, and made it necessary for the Duke to carry back the scene of operations into Flanders. It was on this occasion that Marshal Villars was first opposed to Marlborough. Villars was an able officer, and particularly skilful in the choice of defensive positions; but his vanity went beyond all bounds, and he took to himself the whole credit of the Duke's retreat, though it was owing chiefly to a different cause.

The year 1706 was destined to present a very different spectacle. The Duke had by this time, partly by weight of reputation, partly by his persuasive powers, succeeded in prevailing on the Dutch to leave him unfettered in the command of the allied troops. Though he could not, as he once intended, proceed to Italy with a force calculated to give to affairs, in that quarter, a turn similar to that of 1704 in Germany, he found means to send a body of Prussians to reinforce Prince Eugene, and afford him the means of acting on the offensive. This, along with the boldness of the Prince's tactics, led to the victory of Turin, and the deliverance of Piedmont. In the Low Countries, Marlborough signalized himself by the victory of Ramillies, a battle which, whether we consider it in itself, or in its results, was one of the most remarkable in history. It was planned altogether by himself, and was decided at a time of the day, which left sufficient room to follow it up effectually. The consequence was, the dispersion of the French forces, and the almost total fall of Austrian Flanders; all this too against an enemy who had marched to attack him in the full confidence of triumph. A decisive turn was now given to the war. Louis, humbled by the loss of Piedmont and Belgium, gave over the hope of dictating laws to Europe, and began to discover a disposition to peace. Next year, however, he threw an additional mass of force on the side of the Low Countries, which, joined to the cautious tactics of Vendosme, prevented Marlborough from making much progress. This, together with the success attendant on the French arms in Spain and in Provence, revived the hopes of that easily exalted people, and led, in 1708, to the resumption of offensive operations in Flanders. Marlborough was not long in making them repent their audacity, by the victory of Oudenarde, where daylight alone was wanting to make their loss as great as at Ramillies. Next came the siege of Lisle, an enterprise of great boldness, and prompted probably by Prince Eugene, who had now taken leave of Piedmont, and acted in Flanders along with Marlborough.

The year 1709 was remarkable for the dearly bought victory of Malplaquet, in which the loss on both sides, in killed and wounded, was hardly short of 40,000 men. This carnarge was occasioned by the nature of the French position, which, strong in itself, had been fortified with great care and expedition by Marshal Villars. The determination to attack it originated, there seems little doubt, with Prince Eugene. Such a measure accorded with his bold plan of war, and the responsibility is decidedly put on him in the book that goes by the name of his *Memoirs*, published in 1809, and which, whether proceeding from his pen or not, is evidently the work of a mind intimately conversant with the history of the war. The error, however, appears to have consisted, not so much in the determination to attack, as in the unfortunate delay in carrying it into effect. The allies had made a rapid and well-concerted movement for the investment of Mons, and Villars, commanding an equal force, set himself down in a position too near to allow of the siege being conveniently prosecuted. The movement of Villars took place on the 9th September, on which day, or on the next, it is generally thought the allies ought to have attacked him. But a reinforcement of 12,000 men being on the march, the battle was deferred till the morning of the 11th, without considering to what account the French were likely to turn so precious an interval. Marshal Boufflers had been sent from Paris to serve along with Villars, and though a senior officer, had no objection at this critical epoch of placing himself under his orders. In the course of the action, Villars was wounded and carried off the field, a circumstance to which he did not fail to ascribe the loss of the day. Next year, 1710, the French, taught by past disasters, kept on the defensive, though superior in number. Marlborough and Eugene held the joint command, and took the towns of Douay, Bethune, Aine, and St Venaut. In 1711, Eugene commanding on the Rhine, Marlborough acted alone. Villars was at the head of a very numerous army, and had carried his defensive labours, in the way of lines and trenches, to an extraordinary length. This, which was the last campaign of the Duke of Marlborough, though not distinguished by any battle, is probably that which a tactician would mark as the most brilliant æra in his career. By a series of feints and manœuvres, which it would greatly exceed our limits to recapitulate, he succeeded in deceiving Villars, active and experienced as he was, and in entering, without the loss of a man, those lines which the Marshal had boasted would prove his *ne plus ultra*. This signal exploit was followed by the siege of Bouchain, a place of great strength, and surrounded by inundations. Villars considered his reputation at stake, and repeatedly asserted that he would force the Duke to raise the siege. He durst not, however meet the Duke in a general action, and every other effort of relief was baffled by the Duke's vigilance and activity. Bouchain fell, and with its capture closed Marlborough's military career.

We are now to quit the scene of active operations, and take a retrospect of a less flattering nature. The Duchess of Marlborough having long considered herself the directress of the queen, forgot in her husband's prosperity, the moderation incumbent on a subject. She neglected a due attention to her sovereign, and opened the way for others to undermine her in the royal favour. The two principal agents of the political revolution which ensued, were Mrs Hill, afterwards Mrs Masham, and Harley, afterwards Earl of Oxford. The queen was earnestly desirous to be relieved from the domineering interference of the Duchess, but was very unwilling to lose the Duke's services. Hence, at one time, she found herself obliged to dismiss Harley, greatly against her will. But the humbled state of France, and the offers made by Louis for peace in 1709, joined to the enormous expenditure of war, gave weight to Marlborough's political opponents, and enabled the queen soon after to accomplish a change of ministry. Her husband's death, her own infirm health, compunction for her conduct in early life towards her father, and an aversion to bloodshed, all concurred to make her desire to close her reign in peace. She regarded, and with reason, Marlborough's conduct in the late negociations, as one of the principal obstacles to a termination of hostility. The public relieved from apprehension, and seeing no British interest at stake, was no longer solicitous to prolong a contest by which Austria was to be a chief gainer. The Dutch were actuated by similar feelings, but their leading men continued to be influenced by Marlborough. The latter went every advisable length in opposition to the change of ministry, and finding, at last, that he could not prevent it, made, like a true politician, a merit of necessity, and declared that he would henceforth interfere no more in her majesty's civil affairs, but confine his services to his profession. The weight of his reputation obliged the new ministry to keep him in the command more than a twelvemonth after the fall of his political adherents; and it was not until the end of 1711, that they ventured to deprive him of his employments. This took place after bringing forward certain charges of appropriating to his own use, funds belonging, as they said, to the public. The specific charge consisted in the acceptance, on the part of the duke, of L. 5000 sterling a year, from the contractor for army bread. The duke explained that this and other payments formed a regular allowance to the commander in chief, who, in return, took on himself the whole expence of the secret service. King William, he added, had received in great part those allowances for which he was now censured. Though the Duke's defence is, according to our present notion of a general's honour, unsatisfactory, the wonder is that, with such opportunity as he possessed, and such a fondness for money as has been imputed to him, his enemies should not have discovered much weightier charges against him.

The accusation, such as it was, having produced considerable effect on the public mind, ministers ventured to transfer the command of the forces to a different general. It was in vain that the allies intreated them to let the Duke keep his command, and that Prince Eugene came over to London to endeavour to recall the queen to cordiality in the war. All would not do, and the prince had no other satisfaction than that of shewing, that change of fortune made no alteration in his behaviour towards his illustrious associate in arms. Policy, it is said, in his *Memoirs*, would have dictated a different course—the way to succeed with the queen and her new ministers, would have been to shun and decry Marlborough; but "I threw myself," says the prince, "with rapture into his arms, and the English nation, nay Marlborough's own enemies, must have esteemed me the more for it." The campaign of 1712 soon shewed what the allied cause had lost by the change of a general. The Duke of Ormond was no Marlborough, and he was, moreover, restricted from co operating offensively with the allies. This, and the too hazardous conduct of Prince Eugene, led to the check at Denain, which furnished matter of great exaltation to Villars, and led to a turn of the war in favour of the French. It is needless to add how miserably our affairs were managed at the treaty of Utrecht.

During the year 1712, the Duke of Marlborough remained as a private individual in England. Towards the end of the year he took the determination to go abroad. His course was by Ostend and Antwerp to Aix-la-Chapelle, at each of which places he was received with distinguished honour. He thence proceeded to visit the estate in Suabia, given him by the emperor of Germany, and afterwards passed some time at Hanover. His return to England happened to take place in 1714 at the time of the queen's death. On the accession of

George I. he was restored to all his honours, and declared captain general and commander in chief of our land forces. In this capacity he was not long able to act an efficient part, for age and care had impaired both his mind and body. Soon after giving directions for checking the rebellion in 1715, he retired from public business, and passed his remaining years in the country. The decay of his faculties afforded, it is said, an affecting spectacle, when viewed in contrast with his former splendour. His death took place at Windsor lodge in 1722, in his 73d year. He left no son, but four daughters, and his title has descended to the posterity of his second daughter.

It remains that we say a few words on a part of the Duke's conduct which has been much animadverted upon,—we mean his behaviour to the Stuart family. It appears, from "M'Pherson's State Papers," that he continued to give them hopes of a friendly disposition on his part, after he was evidently connected with the house of Hanover. M'Pherson, it is manifest, was not partial to the Duke's memory, nor slow in bringing forward whatever could constitute a charge against him. At the same time, it would be contrary to historic fidelity to represent the Duke as much fairer than the majority of those who pass their life in courts and cabinets. He would have sided, in all probability, with either Hanover or Stuart, as best suited his political views, and might have leaned decidedly to the latter, had there been any hope of their conforming to the Protestant religion. Those who accuse him of unbounded avarice will do well to recollect, that all the temptations of this nature, offered to him by the French court at the conferences of Gertruydenburg, were completely unavailing. (x)

CHURCHILL, Charles, was born in Vine-street, in the parish of St John the Evangelist, Westminster, in February 1731. His father was for many years curate and lecturer of that parish, and rector of Rainham near Grays, in Essex. Young Churchill was placed at Westminster school at eight years of age, and, in his 19th year, applied for matriculation at Oxford, but was rejected, either from inability to answer the questions that were put to him on his examination, or from a petulant contempt of his examiners, which was mistaken for ignorance. He was afterwards admitted to Cambridge; but instead of revisiting the university, he made a clandestine marriage in London, after the discovery of which, his father took home the imprudent couple to his own house for a twelvemonth. Young Churchill now applied in earnest to such studies as might fit him for the church. At the customary age he received deacon's orders, and in 1756 was ordained a priest. He first preached at Cadbury in Somersetshire, and at Rainham his father's living. At the latter place, he endeavoured to provide for his family by teaching the youth in the neighbourhood; but in 1758, his father's death opened a new prospect to him in the metropolis, where he was chosen his successor in the curacy and lectureship of St John's. For some time he performed his duty in these offices with external decency, and added to his income by private tuition; but about his 27th year he began to relax from habits of industry and decorum, and to plunge into debt and dissipation. The father of his friend, Lloyd the poet, one of the masters of Westminster, persuaded his creditors to accept of five shillings in the pound, and to grant him a release. Amid all the profligacy of Churchill's life, it deserves to be told, that when he had afterwards realised some money by his writings, he voluntarily paid the full amount of his debts. After several poetical efforts, which were either suppressed by advice of his friends, rejected by the booksellers, or which attracted but insignificant notice in a magazine, his attendance at the theatres suggested a subject of satire against a set of men, who have seldom any means of retaliation. The Rosciad appeared in 1761, and its success, together with that of its sequel the Apology, a severe satire on the reviewers who had attacked it, was such as to produce at once fame and profits, and to open new prospects to his ambition. Unhappily the decline of his moral conduct kept pace with the rise of his literary name. His profligacy drew down the displeasure of the dean of Westminster, and had long shocked his parishioners. Churchill conceiving his dignity above reproof, and probably feeling his habits beyond the power of reformation, threw off his clerical character, and with that the few restraints of external decency which it yet imposed. He dressed his uncouth form in a splendid fashionable suit, parted from his wife, and addressed a poem, entitled Night, to his friend Lloyd, which is little more than a doleful exhortation not to blush for immorality. His next publication was the Ghost in 1762, founded on the Cock lane story, but which he contrived to make the vehicle of some characteristic sketches. His acquaintance with Wilkes commenced about this time, and he probably wrote in the North Briton. For this political patron, his Prophecy of Famine was contrived,—a piece, which has strong though scurrilous humour, and was admirably fitted to raise the horse laugh of party and nationality. The Epistle to Hogarth, his next poetical production, was much more personal, and, from its personality, more malignant. Whatever was the cause of the quarrel, and it is by no means certain whether Hogarth's caricature of the Bear and the Mug of Porter (in allusion to Churchill's fondness for that beverage) preceded or followed the poet's angry epistle, it is disgusting to peruse his reproaches of the painter for being old and infirm.

In 1763, Churchill seduced the daughter of a tradesman in Westminster, but, after a fortnight's cohabitation, they were seized either with satiety or repentance, and her father was persuaded to take her back. Her home, however, being made intolerable to her by the ill nature of a sister, Churchill thought himself bound in honour to renew the connexion. While the subject was public, he wrote the Conference, a piece full of penitence and expressions of grief. In the same year, the duel between Wilkes and Martin gave occasion to his poem entitled the Duellist. His *Author*, an inconsiderable effusion, appeared during the same year. His Gothham, published in 1764, has a few strong lines, but is heavy, and without a distinct object or plan. The Candidate was written against Lord Sandwich, when he competed for the stewardship of the university of Cambridge. Churchill, with great impartiality, attacks his Lordship for the same vices which distinguished himself. The two last pieces published in his lifetime, viz. the Times, and Independence, added little to his reputation. Towards the end of October, he accompanied Mr Cotes, one of Wilkes's partizans, on a visit to the exiled demagogue in France. The party met at Boulogne, where Churchill was attacked with a fever, that terminated his life in his 34th year. If his will is to be credited, he left money at his death. On his tomb was written, "Life to the last enjoyed, here Churchill lies."

Churchill died at that early age, when most men are only beginning to distinguish themselves, and his genius certainly contained the seeds of greater excellence than it ever brought to maturity. The poetical character which he did attain, is that of a bold, courageous, but slovenly artist. He has more of the vehemence of Dryden than any other English satirist, but none of that majesty of thought, that pomp of diction, or harmony of numbers, which give the hostility of Dryden in satire the dignity of moral warfare. Cowper gives his character with considerable indulgence, but with some truth, in a passage to his memory. The reader will perhaps need but little criticism to perceive, that there is a confusion of metaphors in Cowper's lines that we allude to, when the poet is first compared to a rider, and, in the next line, placed at his lyre.

> Surly and slovenly, and bold and coarse,
> Too proud for art, and trusting in mere force;
> Spendthrift alike of money and of wit,
> Always at speed, and never drawing bit.
> He struck his lyre in such a careless mood,
> And so disdained the rules he understood—
> The laurel seemed to wait on his command:
> He snatched it rudely from the muse's hand.

(*n*)

CHURN. See Dairy.

CHYLE. See Anatomy, vol. i. p. 730, 801, 822; and vol. ii. p. 16.

CIBBER, Colley, an eminent actor and dramatic writer, was born in London on the 6th of November 1671, O. S. His father Gabriel Cibber, who was a statuary by profession, came from Holstein to England a little before the restoration, and immortalised himself by the two famous images of raving and melancholy Madness, placed on the piers of the great gate of Bethlehem hospital, and by the basso relievo upon the pedestal of the Monument.

Young Cibber was sent to the free school of Grantham in Lincolnshire at the age of 11, and, after remaining there seven years, he stood a candidate for admission into Westminster college. Being disappointed in these views, he was anxious to be sent to one of the English universities, to be educated for the church; but his father having taken an active part under the Earl of Devonshire in the cause of the Prince of Orange, young Cibber repaired to the same standard, and continued for some time to practise the duties of a soldier.

As soon as he received his discharge, he became remarkably fond of theatrical exhibitions, and, in the year 1689, he came upon the stage for a weekly salary of ten shillings. Neither his person nor his voice seemed well fitted for any great dramatic effort, and he was accordingly employed for a considerable time in the lowest characters. When Queen Mary, however, ordered Congreve's *Double Dealer* to be acted, Mr Kynastown, who originally played the part of Lord Touchwood, was taken suddenly ill, and upon the recommendation of Congreve, Cibber undertook the character at a very short notice. The ability with which Cibber performed his part, gained him the particular applause of Congreve, who recommended him to an increase of salary from 15s. to 20s. per week. About this time, his father settled upon him an annuity of £20 a year; and in 1693 he married a Miss Shore, of whose beauty and accomplishments he had been very suddenly enamoured.

On the opening of Drury-lane theatre in 1695, he wrote an original prologue, which was admitted as the best that had been offered; but so low was his reputation as an actor, that it was accepted solely on the condition, that he should relinquish any claim to recite it himself.

Cibber gained great fame by his performance of Fondlewife, in the Old Bachelor, where he imitated Dogget, the original performer of the part, in the happiest and closest manner; and his name was raised still higher by his first dramatic production, called *Love's Last Shift*, or the *Fool of Fashion*, which appeared in 1696, and which Lord Dorset, who was then lord chamberlain, pronounced to be the best play he had ever read. From this time Cibber rose with rapidity in the public estimation. His *Woman's Wit*, which appeared in 1697, was however ill received. His *Xerxes*, which was brought out in 1699, was acted only one night; and his *Careless Husband*, which appeared in 1704, though by no means a perfect play, has been much admired, and is reckoned his principal comedy.

In 1711, Cibber became joint manager and patentee of Drury-lane Theatre, along with Collier, Wilkes, and Dogget; and, in 1717, he brought forward his comedy of the *Nonjurors*, which, being levelled against the jacobite party, was acted for eighteen successive nights, and obtained for him from the king L. 200, and the office of poet-laureat. In 1740, he published *An Apology for the Life of Mr Colley Cibber, Comedian, with an Historical View of the Stage during his own time:* a very lively and entertaining work. In 1745, when he was in his seventy-fifth year, he acted with great spirit the character of Pandulph, the pope's legate, in the new tragedy written by himself, and entitled *Papal Tyranny in the Reign of King John.* The last of Cibber's literary labours, was a work entitled *Remarks on Middleton's Life of Cicero*, which was published in 1747, and which added nothing to his fame. Worn out with years, Cibber died suddenly on the 12th December 1757, in the eighty-seventh year of his age. His man-servant had talked with him at 6 o'clock in the morning, when he apparently enjoyed his usual health; but, at 9 o'clock, he found he had expired, in the same position in which he had left him. Cibber left behind him a son and a daughter, both of whom disgraced the memory of their father.

In his dramatic character, Cibber has drawn a very faithful picture of himself, which we shall give in his own words: "I was vain enough to think," says he, "that I had more ways than one to come at applause, and that, in the variety of characters I acted, the chances to win it were the strongest on my side. That if the multitude were not in a roar to see me in Cardinal Wolsey, I would be sure of them in Alderman Fondlewife. If they hated me in Iago, in Sir Fopling they took me for a fine gentleman. If they were silent in Syphax, no Italian eunuch was more applauded than I when I sung in Sir Courtly. If the morals of Æsop were too grave for them, Justice Shallow was as simple and as merry an old rake as the wisest of our young ones could wish me; and, though the terror and detestation raised by King Richard might be too severe a delight for them, yet the more gentle and modern vanities of a Poet Bayes, or the well bred vices of a Lord Fopling, were not at all more than their merry hearts or nicer morals could bear."

Besides his two Letters to Pope, his Apology for his own Life, and his Remarks on Middleton's Life of Cicero, Cibber wrote the following dramatic pieces: 1. *Love's last Shift*, 1697; 2. *Woman's Wit*, 1697; 3. *Xerxes*, 1699; 4. *Love makes a Man*, 1700; 5. *King Richard the Third*, 1700; 6. *She would, and she would not*, 1703; 7. *Careless Husband*, 1704; 8. *Perolla and Izidora*, 1706; 9. *Schoolboy*, 1707; 10. *Comical Lovers*, 1707; 11. *Double Gallant*, 1707; 12. *Lady's last Stake*, 1708; 13. *Rival Fools*, 1709; 14. *Venus and Adonis*, 1715; 15. *Myrtillo*, 1715; 16. *Nonjuror*, 1718; 17. *Ximena*, 1719; 18. *Refusal*, 1720; 19. *Hob, or the Country Wake*, 1720; 20. *Cæsar in Egypt*, 1725; 21.

Provoked Husband, 1727; 22. *Rival Queens*, 1729; 23. *Love in a Riddle*, 1729; 24. *Damon and Phillida*, 1729; 25. *Papal Tyranny in the Reign of King John*, 1745. (*j*)

CICADA. See Entomology.

CICCA, a genus of plants of the class Monœcia, and order Tetrandria. See Botany, p. 324.

CICER, a genus of plants of the class Diadelphia, and order Decandria. See Botany, p. 283.

CICERO, Marcus Tullius, born in the 647th year of Rome, was descended from an ancient and honourable family, which had been of equestrian rank since the time of its first admission to the freedom of the city. He was, indeed, called at one time a *Novus homo*, but only because he was the first of his family who sought and obtained public magistracies. His birth-place was Arpinum, now part of the kingdom of Naples. The family seat was about three miles from the town of Arpinum, and is described in one of Cicero's letters as exceedingly beautiful, being surrounded with groves and shady walks leading from the house to the river Fibrenus, which was divided into two equal streams by a little island covered with trees. Here stood a portico, contrived both for study and exercise, to which Cicero retired for meditation. A clear and rapid stream, shaded with poplars, murmured through a rocky channel, and fell a little below the island into the noble river Liris, in a cascade. This place, consecrated by the memory of Cicero, was lately inhabited by a convent of monks, and was called the Villa of St Dominic.

Cicero's first name, corresponding to our baptismal name, was Marcus, after his father: Tullius was the family name, signifying a flowing stream, probably from the conflux of waters on their grounds: Cicero, the other family name, is ascribed by Pliny to the reputation of his forefathers for the cultivation of vetches. His early education was, according to the Roman custom, committed to a discreet matron; but when of age to be placed at a public school, he was brought to Rome, where his father had a house. There, we are told by Plutarch, he was so distinguished, that his school-fellows attended him in a body to and from school, giving him the place of honour among them, and that parents often visited the school to see so extraordinary a youth. Among the instructors of his youth was the poet Archias. Under him he applied chiefly to poetry, though with what small success is proverbially known. This circumstance, however, shews the universality of his taste, if not of his talents. Indeed, it is observable, that few geniuses which have ever swayed mankind by eloquence, from Cicero to Chatham and Fox, have left their love of poetry unrecorded in some effort to compose it. On assuming the manly dress, he was introduced into the forum, under the care of Quintus Curtius Scævola, the principal lawyer of the age. The peace of Rome being soon after disturbed by the Italic or Marsic war, the forum was, as usual, deserted, and the orators repaired to fight at the head of their military divisions. Cicero went out as a tiro under Pompeius, Strabo, and Sylla. Returning to Rome, he resumed his philosophical studies under Philo, chief of the academy. Molo, an eminent pleader and master of rhetoric, was his next teacher. Amidst these studies he published some remarks on Rhetorical Invention, translated Xenophon's Œconomics, and versified the Phænomena of Aratus. But his taste both in poetry and rhetoric seem, at this time, to have been rude and imperfect.

At the age of six-and-twenty, our orator pleaded his first cause with equal honour to his eloquence, his humanity, and intrepidity. Rome was now under Sylla, whose proscriptions had silenced all laws. A citizen, Roscius Amerinus, had been stript of his inheritance by two of his relations, who had assassinated his father, though he was not in the list of the proscribed, and fearing that the son might reclaim his property, charged him with the murder which they had themselves committed. They were supported in this accusation by one who had participated in the booty, Chrysogonus the freedman of Sylla. Not another advocate at Rome would expose himself to the terrible resentment of such antagonists, when Cicero, with youthful boldness, undertook to defend the innocence of Roscius, and gained his cause. His address in this business was very conspicuous; for while he attacked the freedman of Sylla with indignation, he pretended to consider Chrysogonus's conduct as unknown to Sylla, and unwarranted by his authority. He remained in Rome a year after this event, engaged in the business of pleading, and in one cause exposed himself still more openly to the danger of the tyrant's resentment. In the cause of a woman of Arretium, he defended the rights of certain towns in Italy to the freedom of Rome, which Sylla had taken away, and gained his plea, though opposed by the distinguished orator Cotta.

He was 28 years old when he set out on his travels. At Athens he studied Greek philosophy with that deep curiosity and discrimination which has enabled him to be the most faithful reporter of its outlines; and here, as well as at Rhodes and in Asia, he mingled the study of oratory with that of philosophy. At the end of two years he returned with his lungs repaired, his constitution confirmed, and the solid faculties of his mind polished to their utmost brilliance. At this time the greatest of the Roman orators were Cotta and Hortensius. The former was a decided mannerist, and so remarkable for a swinging action, that it was satirically said he had learnt his eloquence in a boat. Hortensius had been hitherto called the king of the Roman bar, but his crown was soon to be transferred to Cicero. Our orator, however, did not think himself yet entirely accomplished in the exterior requisites of a speaker, but took lessons from the eminent players, Æsopus and Roscius, the latter of whom he successfully defended in a pecuniary cause.

In his 31st year, he was chosen one of the questors. These officers, who were sent annually into the provinces as assistants to, or rather as checks upon, the proconsuls or governors, had the care of the provincial revenues, of providing grain for the armies abroad, and the public consumption at home. The office was the first step in the ascent from plebeian to patrician dignity, as from the questors who had been censors, the vacancies of the senate were supplied. The marriage of Cicero probably took place in the same year. He was appointed to the questorship of Sicily, and filled it so as for ever after to possess the gratitude of the Sicilians. We shall presently have occasion to observe how very rarely the provinces had the good fortune to have a Cicero among them. Before he left Sicily, he made the tour of the island. At Syracuse, he enquired of the magistrates if they could point out to him the tomb of Archimedes. It marks the degradation of a conquered people, that they knew not the spot where the dust of their greatest genius reposed. But Cicero discovered it. When they had carried him to the gate where the greatest number of their old sepulchres stood, he observed, in a place overgrown with shrubs and briars, a small column, of which the head just appeared above the bushes, with the figure of a sphere and a cylinder engraved. On clearing the ground, he found also (though mutilated) the inscription which he expected:

So Tully paus'd, amid the wrecks of time,
On the rude stone, to trace the truth sublime;
When at his feet, in honour'd dust disclosed,
Th' immortal sage of Syracuse reposed.—ROGERS.

After his year of questorship, he returned to the Roman bar, and was elected ædile by the universal suffrages of the tribes. The ædiles were police magistrates, whose duty was to take care of the public buildings, to inspect the markets, weights and measures, and to regulate the shows and public festivals. At this period, in the strength of his powers, and progress of his honours, he was called upon by the Sicilians to accuse Verres, their base and violent oppressor. Verres, guilty as he was, had the support of the powerful at Rome. The great men, who regarded it as one of the rights of office to fleece the provinces assigned to their charge, made common cause with him, and used every means to disarm the laws. Cicero demanded three months and a half to go to Sicily, and collect proofs against the culprit; but aware that it was in view to postpone the trial till next year, when the friends of Verres were expected to be the prætor and consuls, he collected his facts in 50 days, brought his evidence to Rome like a thunderbolt on the accused, and *by one speech*, in which he produced witnesses of every fact, confounded his adversary Hortensius, and raised such a storm of indignation against Verres, that he was advised not to wait for judgment, but to betake himself to exile. The lenity of Roman law did not seek for farther vengeance on a Roman citizen, when he went voluntarily into banishment. Verres, whose crimes deserved an hundred deaths, fell afterwards a victim to Octavius and Anthony. Having refused to the latter some Corinthian vases and Greek statues, of which he had plundered the Sicilians, he was proscribed; and Verres and Cicero died by the same persecution.

On this occasion, the only one, as Cicero boasted, in which he had hitherto appeared as an accuser, he pronounced only two orations, but left five others as models of the style in which an accusation should be supported in all its parts. The two last of his Verrine orations are regarded as the masterpieces. The object of one of them is to expose the rapine and injustice of Verres, the other his more wanton barbarities. The first is remarkable for the variety and richness of its detail, the interest and picturesqueness of its narrative, and, above all, by the art which he employs to prevent satiety in a series of robberies; the other is still more admirable for its vehemence and pathos. It displays all the resources which the orator can bring, to work upon the hearts of his audience, and to excite their moral indignation. A frightful picture, indeed, those speeches exhibit of the Roman governors in their arbitrary use of "brief authority," and a full display of the desolate corruption which had grown over the stagnated justice of Roman law.* At the time that Verres was entrusted with the prætorship of Sicily, its sea-coasts were infested by pirates, and though the prætor's duty was to support a fleet for the protection of commerce, he employed that trust only as the means of new exactions. Obliging the soldiers and sailors to purchase immunity for their services on board the defensive fleet, he manned it so imperfectly, or rather so totally dismantled it, that it was wholly unfit for service. At the head of this miserable squadron he put not a Roman, as he was bound to do by law, but a Sicilian, Cleomenes, whose wife was the prætor's mistress. At the first sight of the pirates, the Roman fleet took to flight, Cleomenes setting the example. The pirates burnt their deserted ships, and entered Syracuse in triumph. This disgrace to the Roman arms made considerable uproar at Rome. It was notorious, that the captains of the galleys had acted from necessity, as they had only followed their admiral in vessels which could not have fought the pirates. Yet Verres brought those innocent men loaded with irons to imprisonment and trial. Cleomenes was alone excepted from accusation, though he had fled first. On the contrary, he took his seat at the side of the prætor, and was seen as usual familiarly talking with him. The men of the most respectable birth and character in Sicily, when they pleaded their cause, were threatened with death if they uttered the name of Cleomenes, and, when they alluded to the true causes of their retreat, were struck over the eyes, at the command of Verres, by the lictors. When the dreadful sentence was passed, its horrors were even extended to their relatives. Parents, says the orator, were interdicted the sight of their children; they durst not bring them clothing or food. Stretched before the thresholds of their prisons, there did miserable mothers pass the night in tears, without being able to obtain a last embrace of their sons. There they sought as a favour to breathe the last sighs of the condemned, but they sought it in vain. It was there, that the barbarous servant of Verres, the lictor Sergius, the terror of the citizens, established a revenue from the agonies and tears of the unfortunate. So much he asked for leave to visit your child; so much to give him food. Nobody refused it. What will you give me to make your son die by one blow, that he shall not suffer protracted pain? Horrible trade of tyranny, when life was not sold as a favour, but the promptitude of death itself. But does the outrage on humanity stop here, or can barbarity itself go farther? Yes, says the tyrant, when they have been executed, their bodies shall be exposed to beasts of prey; and the parents of the unfortunate must purchase a privilege to bury them. Such were some of the facts, all substantiated by evidence, which Cicero charged against this culprit with strong and pathetic eloquence. When he comes to the particular case of Gavius, he exhibits a most minute and strong case of oppression, which makes even at this day the reader's blood boil with indignation; but must have roused still stronger sensations in the bosoms of his audience, as he appealed to a principle, which was absolutely religious in the Roman mind, namely the respect which was maintained for the name of a Roman citizen. Is it lawful, said St Paul, to scourge a Roman? That sacred title the greatest power durst not violate with impunity; and the republic was ready to carry war to the utmost corner of the world, to avenge an outrage committed on a single citizen,—a sublime principle, which imposed respect for the Roman name on the fiercest barbarians, while it taught the people themselves to love its value. In the case of

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* There was not a considerable estate in Sicily disposed of by will, where Verres had not his emissaries at work to find some flaw in the title, or some omission in executing the conditions of the testator, as a ground of extorting money from the heir. The tenths of the corn in all the conquered towns of Sicily belonged to the Romans, as it had formerly belonged to their own princes. By an outrageous edict respecting those tithes, Verres threw the property of the whole island into the power of his officers, to whom he farmed the taxes, who seized the whole crops, and obliged the owners to compound at mercy for what was left to them. From the registers that were kept in every town, it appeared, that during three years of Verres's government, above two-thirds of all the farmers had deserted their farms, and left their lands uncultivated. Montesquieu tells us of savages in Louisiana, who cut down the tree in order to get the fruit. Behold, says he, an emblem of despotic policy!

Gavius, where Verres had violated this law, the genius of the orator seems to expand with the horrible richness of his subject, and he surpasses himself in eloquence, as much as Verres surpasses the ordinary limits of human cruelty.

Cicero passed from this accusation to fulfil the duties of his office as curule-ædile. The people were passionately fond of public festivals, and it belonged to that office to supply the greater part of those at his own expence, the public allowance for them being small, according to the frugality of the old Roman republic. It was dangerous to be frugal on such occasions, as Mamercus had lost the consulship by declining the ædileship; yet Cicero avoided the opposite extreme of prodigality, by which Cæsar had ruined his fortune. The Sicilians, during his ædileship, gave him effectual proofs of their gratitude, by supplying him largely with all kinds of provisions which their island afforded, for the use of his table and the public feasts; but, instead of making any private advantage of their liberality, he applied the whole to the benefit of the poor, and augmented his popularity by reducing the price of the markets.

His private affairs, in the mean time, though not flourishing, were kept, by good management, in a respectable condition. He had married Terentia, a woman of family, whose fortune added to his own patrimony, enabled him to purchase a house on the Palatine Hill in Rome, and keep up a handsome villa at Arpinum. As there was no honour in the state to which he might not pretend, he was careful to cultivate the favour of the people; and, at the same time, it must be owned, that, amidst a general disposition to patriotism, he kept the favour of the powerful by accommodations, which, in rigid virtue, cannot be defended. Pompey was aiming at power beyond the limits of the constitution; yet the necessity which he found for that great man's support, made him subservient to his views of ambition. In his fortieth year, Cicero was nominated to the prætorship: he entered his office on the ensuing year, and presided over the courts of justice with great integrity. But the famous oration which he made in favour of the Manilian law, which conferred almost sovereign powers upon Pompey, though one of the noblest monuments of his eloquence, can only be considered as an interested piece of policy, to ingratiate himself at once with Pompey and Cæsar: the former of whom desired the dangerous power which the Manilian law conferred upon him for the sake of its immediate use; the other wished Pompey to obtain it, most probably that he might establish a precedent for enormous military commissions, which his conscious genius foretold him that he should one day possess.

Cicero had now the consulate in full view. On the expiration of his prætorship, he therefore refused to accept of a province. The consular election took place in his forty-third year. But to pass, for a moment, from the view of his public to his private life, from the statesman to the scholar, it is interesting to find him, at this busiest period of his life, as eager in the pursuit of books, and fine specimens of art, as if his time and fortune had been unoccupied by other objects. In his beautiful retreat at Tusculum, he had constructed rooms and galleries in imitation of the schools and porticos of Athens, which he called by their Attic names of the Academy and Gymnasium, and designed for the conferences of his learned friends. He had given Atticus a general commission, to purchase for him any piece of Grecian art or sculpture which was elegant and curious: a commission which Atticus executed to his great satisfaction, and sent him, at different times, several cargoes of statues. So intent was Cicero on embellishing his Tusculan Villa, that he sent over to Atticus the plans of his ceilings, which were of stucco-work, in order to bespeak pieces of sculpture or painting to be inserted in the compartments. Nor was he less intent on forming a Greek library by the same help. Atticus was remarkable, above all men in his rank, for a family of learned slaves, having scarce a footboy in his house who could not both read and write for him. For those copies, however, it appears that Atticus had demanded a sum which the other was yet unable to raise. "Pray, keep your books for me," says Cicero, in one of his letters to Atticus, "and do not despair of my being able to make them mine; which, if I can compass, I shall think myself richer than Crassus, and despise the fine villas and gardens of them all." In another letter he continues, "I am setting apart all my little rents to purchase that relief (a collection of books) for my old age." In a third letter he says, "that he placed all his hopes of comfort and pleasure, whenever he should retire from business, on Atticus preserving his library for him."

It was greatly to the honour of Cicero, that one of the motives for electing him to the consulship, was the general fear which prevailed of an impending conspiracy. When chosen to that high office, in his forty-fourth year, he found the public tranquillity endangered from several causes. The sons of those who had been proscribed by Sylla, were brought forward by the tribunes as candidates for public offices. An Agrarian law, a measure at all times full of hazard, was proposed by the tribune Rullus. The law of Otho, for appropriating separate seats in the theatre to the equestrian order, occasioned several popular tumults. Above all, the designs of Catiline were aimed at the vital principles of peace and social order. The colleague of Cicero, *Antonius*, was quite incapable of co-operating with him, either by capacity or virtue. Cicero, therefore, judiciously contrived to get rid of him, by persuading him to accept of the province of Macedon, which he had himself obtained by lot. His eloquence and influence were next employed, in opposing the scheme of the demagogue Rullus for an Agrarian law, to be enforced by a decemvirate of commissioners, who were to have absolute power for five years over all the revenues of the republic; to require an account from all generals of spoils taken abroad; to settle colonies; distribute, buy, and sell land, and judge of the rights of proprietors at pleasure; and, in short, to command all the money and forces of the empire. In this business, Cicero repeatedly challenged the tribunes to come face to face, and dispute with him. They were forced at last to submit to him.

The detail of the Catilinarian conspiracy belongs to a different place in our work. It is sufficient to say, that, after he obtained a clue which made him master of all the labyrinth of that wretch's plans, he obtained a decree of the senate, ordering the consuls to take care lest the republic should receive any detriment. By those few and pithy words, they were invested with almost dictatorial power. Cicero delegated the charge of foreign affairs to Q. Metellus, reserving to himself that of the city. Accompanied by a large body of friends, and armed with a breast-plate, he descended into the Campus Martius, where the conspirators, not daring to move Catiline again, underwent a repulse. Thus rendered desperate, the incendiary summoned his party by night, and fixed upon a day for setting fire to the city, massacring the chief senators, and seizing the capitol. In the mean time, he had engaged two Roman knights to as-

assassinate Cicero in his own house; but the consul being acquainted with all his designs, refused admission to the assassins.

This was the state of the conspiracy, when Cicero delivered the first of those four speeches that were delivered upon the occasion of it, and are still extant. The senate had been summoned to the temple of Jupiter in the capitol, where it was not usually held, but in times of public alarm. The audacious appearance of the traitor in this place, drew down that memorable burst of the orator's eloquence, in which he indignantly denounced to Catiline the discovery of his treasons, and the certainty of his punishments; and, after detailing to the senate whatever had been done at the meetings of the conspiracies, pressed Catiline to quit the city, telling him that the gates lay open, and that nobody should prevent his departure. This terrible oration was the first punishment which Catiline suffered, by his folly in going to the senate. Yet neither the voice of Cicero, nor of his own conscience, could entirely deprive him of the courage to attempt a reply. But though the law forbade any senator being interrupted, he had scarcely pronounced a few vague phrases, when murmurs began on all sides, which speedily swelled into a cry of indignation, and the names of parracide and incendiary were rung in his ears.

Finding it impossible any longer to wear the masque, he rushed out of the senate, vowing, " that he would extinguish, under the ruins of his enemies, the fire which they were lighting around him."

The event justified Cicero's political sagacity: Catiline, the following night, went out of Rome with 300 desperadoes, and put himself at the head of the troops of Mallius. The issue of his bloody struggle with the troops of the republic is well known. After a vain attempt to push his escape over the Appennines into Gaul, his miserable army engaged with the forces of Petreius, and were cut off to a man.

After Catiline's departure, Cicero mounted the rostra, and, in his second Catilinarian oration, gave the people an account of all that had passed. His object was, to dissipate the false alarms which the conspirators insidiously spread, exaggerating their own resources, and the danger of the republic: he proved, that it was only in Rome that Catiline could strike a blow, and, being driven from thence, that he was for ever lost. The imprudence of the conspirators who were left behind by Catiline, precipitated their destruction, even before the death of Catiline himself. Cicero detected Cethegus, Lentulus, and others of them, in treasonable correspondence with the ambassadors of the Allobroges, produced their letters in the senate, and on the clearest evidence, and even on their own confession of guilt, obtained a decree of the senate for putting them to death. Thus ended a conspiracy, in which some of the most powerful men in Rome were suspected of having been implicated, though its principles, and its avowed agents, were the most abandoned and atrocious. While the recollection of Cicero's services was fresh in the public memory, all orders of society joined in the most grateful applause, and perhaps no man ever enjoyed a more enviable triumph. Catalus, in the full senate, declared him the father of his country; and Cato repeated it from the rostra, with the loudest acclamations of the people. This glorious title, the imperial tyrants of Rome were proud to extort from slaves and flatterers, which Cicero obtained from the free vote of the senate and the people.

When Cicero's consulship was concluded, he resigned it, according to custom, in a full assembly of the people. This ceremony was generally accompanied with a speech from the expiring consular; and, from such a speaker as Cicero, an interesting address was naturally expected. Metellus, one of the new tribunes, invidiously determined to disappoint both the orator and the people; and when Cicero had mounted the rostra, declared that he would not suffer him to speak. On which Cicero, who was never at a loss, instead of pronouncing the ordinary form of the oath, raising the tone of his voice, swore so loud that all the people could hear him, " that he had saved the republic and the city from ruin;" which the multitude below confirmed with an universal shout, crying out, " that it was true."

——— *Roma parentem*
Roma patrem patriæ Ciceronem libera *dixit.*

From the time of his consulate, Cicero's influence in Rome began to decline. The rising popularity of Cæsar, the triumphal return of Pompey from Asia, and his reconciliation with Crassus, which laid the foundation of the first triumvirate, occupied the minds of men, and confined the stream of power to a particular channel. Cicero employed himself chiefly in literary and forensic pursuits. He composed the history of his consulate in Greek, for his friends Atticus and Possidonius, and he made the same theme the subject of three books of verse. He defended several considerable causes; and thus endeavoured, by conferring new obligations, to compensate the loss of former favours. He was, indeed, sensible that a storm was gathering against him. He had incurred the hatred of the violent, and abandoned Publius Clodius, by appearing as an evidence against him, when prosecuted for violating the mysteries of the *Bona Dea*. Clodius, who was resolved upon his ruin, had, by means of a plebeian adoption, made himself eligible to the tribuneship of the people; and, as he was a political tool of the triumvirate, he was supported by Cæsar and Pompey, though they assured Cicero that there was no intention of injuring him. Clodius, however, as soon as he was made tribune, began his attack, by proposing a law, that whoever had been concerned in the death of a Roman citizen should be deemed guilty of treason against the state. This was so obviously aimed against Cicero, that he immediately assumed the habit of a mourner, and went about soliciting the protection of his friends. Such was the regard he still inspired, that the whole order of knights went into mourning, and joined in his supplications; and young Crassus, the son of the triumvir, who had been his pupil in eloquence, attended upon him with a large body of the Roman youth, in order to defend him from the violence of Clodius and his mob. His counsels were now perplexed by the different opinions of his friends. The question was, whether he should remain in Rome, and defend himself by force, or save the effusion of blood, by retreating till the storm should blow over. Cato advised him to the latter plan: It is unfair, as many have done, to impute his inclination to this advice to timidity; for no man seems to have felt the pain of exile more deeply than Cicero, although the fears and intreaties of his family might operate on his resolution. He therefore applied to Cæsar, to take him as his lieutenant into Gaul. The artifices of Clodius, who pretended to wish for a reconciliation, induced him to change his purpose, and decline accepting; by which he offended that commander, or, perhaps, rather afforded him a pretext for sharing in the base desertion of him; which Pompey, with still less excuse, did not blush to be guilty of. Clodius, then, directly impeached him for having put to death Lentulus, Cethegus, and the rest of Catiline's associates, without a legal trial. Thus abandoned, the father of his country went voluntarily into banishment, and Rome suffered sentence of interdiction from fire and water to be passed against him; though the friends of liberty still secretly shed tears, and put up prayers for his welfare. In his 49th year, the fifth from the time of his consulate, he wandered desponding over the south of Italy, and finally settled in Greece. The melancholy which his letters express during this sad period of his existence, have drawn upon him the censure of weakness; and they certainly discover him to have been no Stoic: but much allowance should be made for a mind exquisite in its texture, though great in its compass,—for sensibility, flushed and warm with recent glory,—for genius, torn from the community which it had saved and adorned.

His enemy, Clodius, who was now the pest and fury of the republic, had, however, but a temporary triumph over one who was loved by the great body of the people. He burnt Cicero's villas, and house on the Palatine, and confiscated his effects; but when the estates were brought to auction, none would bid for them. Pompey himself began to be ashamed of having deserted him, and, being irritated at Clodius for some instances of insolence which came nearer his own dignity, joined with the party who planned his recal. A decree for that purpose was at first successfully resisted by the tribune Clodius, who, in defiance of the senate, absolutely slaughtered the partizans of Cicero in the forum. But the senate at last carried their point. The citizens of the towns of Italy flocked to Rome from all quarters to support their authority. The news of the favourable decree was received at the theatres with acclamations and tears of joy. Æsopus, the tragedian, when acting on the stage a part in which he invoked the name of Brutus, substituted Tullius in its place, and the people were so affected that they called for it over and over again. A meeting of the tribes was held in the field of Mars, and the law of the senate was confirmed by the unanimous suffrages of all the centuries. This was one of the last acts of Roman liberty. The day of the patriot's return to Brundusium, happened to be the annual festival of the foundation of the town, and the birth-day of his daughter Tullia, who came to that place to meet him. The fame of his landing and progress to Rome, drew multitudes from all parts, so that the whole road from Brundusium to Rome was one crowded and continued street; nor was there a prefecture, town, or colony through Italy, which did not decree him statues, and send a deputation to pay him compliments. All Italy, to use his own words, brought him back upon its shoulders: "That one day," he says, "was worth an immortality, when, on my approach towards the city, the senate came out to receive me, followed by the whole body of the citizens, as if Rome itself had left its foundations, and marched forward to embrace its preserver." As soon as he entered the gates, he saw the steps of all the temples, porticos, and tops of houses, covered with people, who saluted him with an universal acclamation; and as he marched towards the capital, fresh multitudes expected his arrival. So splendid was his triumph, that he had reason, he says, to fear lest the people should imagine that he had himself contrived his late flight, for the sake of so glorious a restoration. After some difficulties, occasioned by the rancour of Clodius, his property was restored to him, and his demolished mansion rebuilt at the public expense. His reimbursements, however, were not adequate to his losses.

The persecution he had undergone rendered him still more cautious in his political conduct, and while he studied to keep on the best terms with Pompey, Cæsar, and Crassus, he exercised his eloquence generally as a defendant to secure him personal friendships. In the 54th year of his age he was admitted into the college of Augurs. He is said to have been above the general faith of his countrymen in augury, but the situation carried dignity with it. The death of the atrocious Clodius, who was killed in an affray, by Milo, soon after gave occasion to one of the capital exertions of his oratorial powers; and though the appearance of Pompey's soldiers discomposed, and even paralyzed his elocution on this occasion, so that Milo was banished, the pleading exists as a model of defensive eloquence.

In his 56th year he went as proconsul to Cilicia, the jurisdiction of which belonged to the isle of Cyprus. His conduct in this commission was highly honourable to his character, particularly towards the Cappadocian king, Ariobarzanes, who had been miserably scourged by the Roman governors and generals. The debt for which that unfortunate prince paid exorbitant interest to Pompey, and owed also to Brutus, seems to have placed Cicero in a situation of distressing dilemma. It shewed the humanity of our orator, however, in a high light, that when Ariobarzanes came to offer him a present, the usual peace-offering to Roman governors, he generously refused it, but pressed him to apply it to the payment of his debt to Brutus. The poor Cappadocian prince was obliged to excuse himself, by pleading the necessity of satisfying more pressing demands, namely those of Pompey, who, for good reasons, could not be refused. Brutus solicited his assistance to recover debt in another quarter, which still more eminently displayed Cicero's sense of justice. The city of Salamais owed Brutus a debt of £20,000, and Scaptius his agent (the lovers of liberty will peruse the anecdote with pain) had, in harassing the Salaminians for payment, shut up their senate till five of them were starved to death. Brutus attempted to place this Scaptius in the favour of Cicero; but Cicero, disdaining to make the ties of friendship a bond of injustice, deposed Scaptius from his prefecture, having laid it down for a rule, to grant no man *a command* who was concerned in trade, or negociating money in the province. On similar principles he had ordained, that no debt under his government should bear an interest of more than a per cent. per month. Scaptius demanded four per cent.; but though the agent for Brutus's debt, he obliged him to accept of payment on those legal terms, and helped the unhappy Salaminians to release the bond by remitting to them the dues of his own office. "If Brutus does not approve of this, (he says in writing to Atticus on the subject,) I shall be sorry indeed that he has any occasion to be angry with me, but much more *not* to find him the man that I took him to be." In another epistle to Atticus, he adds, "How could you desire me to grant troops to Scaptius for the sake of extorting money? Could you, if you were with me, suffer me to do it? If I really had done such a thing, with what face could I ever read again, or touch those books of mine with which you are so pleased?" It has been usual to tax the memory of Cicero with a pliable and timid spirit. Yet, to behave with such integrity, must have required courage as well as generosity. He restricted his own troops from even the customary foraging tributes which were levied on the inhabitants of the provinces, allowing them only house-room, and obliging them to lodge in tents when that exaction could be spared. He refused the presents of the neighbouring princes, kept a table at his own expence instead of that of the province, was accessible to all ranks of people, gentle in his punishments, and careful of the public money. In his military operations, he checked a formidable incursion of the Parthians, and took the strong town of Pindenissum. Perhaps it was fortunate for his military reputation, that there was no necessity for a pitched battle with the Parthians. His successes, however, though not splendid, were sufficient for the protection of the province, and were as complete as the occasion seems to have required. It was then customary, even on very moderate triumphs, for the army to hail their general imperator, and Cicero renewed this honour. In his applying to the senate for a supplication, and entertaining hopes of a triumph, the admirer of his virtue must regret to find an instance of his vanity. Cato opposed the decree with many expressions of regard for the truly valuable parts of his character, but deemed such honours too cheaply given. The offence which Cicero expresses on this occasion was unworthy of himself, and forms a displeasing contrast, both to the noble conduct which has been already described, and to the candid and manly sentiments of Cato on that occasion.

His approach to Rome was honoured by a vast concourse of the citizens who came out to salute him, but he found the city full charged with the dissension between Cæsar and Pompey, which was soon to explode. Cicero made use of all his influence to prevent the fatal rupture, but Cæsar was in jest when he pretended to negotiate, and Pompey was more afraid of peace than war, probably from knowing the mind of his rival. Cicero chose his side when it was no longer possible to be neutral, but with his eyes full open to the dilemma of calamities which awaited his country in the event of either rival succeeding. He seems to have dreaded the cruelty of Cæsar, more than the event justified; but his fears of Pompey's incapacity were but too well founded, and even should he have succeeded, the language which Pompey himself held, foreboded neither clemency to the vanquished nor liberty to the republic. Cæsar, conscious he could not expect Cicero's support, wished to exhort him to neutrality, and to retire into Greece. His arrival at Pompey's camp, though pleasing to the majority, excited only a momentary enthusiasm, but proved unimportant to the cause, or to his own personal satisfaction. He has been blamed for passing railleries on the prospects and counsels of his party before the battle of Pharsalia; but when he saw the real inequality of Pompey's ostentatious Asiatic parade of war opposed to the veterans of Cæsar; when he remonstrated against risking a battle, and ridiculed the overweaning confidence of his party; it is no wonder that he enforced his arguments with ridicule, and the pity was for his associates, that they did not feel the force of his rebukes. A seasonable illness excused his presence at the fatal battle of Pharsalia, and he afterwards refused all command in the forlorn cause, and took the first opportunity of returning to Italy. Indeed the cause soon was utterly hopeless. The sons of Pompey were men whose success was still more to be deprecated than that of Cæsar's, and Cato's prolonged resistance was but the prelude to a tragedy, which could have no finer conclusion than his own act of suicide. He therefore determined to return to Italy, and landed at Brundusium at this time. He was distressed in his private as well as public circumstances. The unnatural conduct of his brother Quintus, who, in order to make his peace with Cæsar, threw all the blame of their late hostility on Cicero, must have stung him deeply. In spite of this conduct, he was afterwards on terms of friendship with this brother, and they suffered, as will be seen, under a common proscription. He was likewise in pecuniary difficulties, owing to the advances he had made to Pompey, and the extravagance of his wife, so that Atticus's purse was, for the present, his chief support. The arrival of Cæsar at Brundusium, relieved his suspense. At their meeting, the generosity of Cæsar imposed no necessity of his saying or doing any thing beneath his dignity; for the conqueror no sooner saw him, than he alighted and ran to embrace him, and afterwards walked with him alone, conversing familiarly for several furlongs. From Brundusium he followed Cæsar to Rome, with a resolution to spend his time in study and seclusion, till the republic should be restored to some tolerable state. His books, which had before been only the amusement, were now become the support of his life. *A quibus antea delectationem modo petebamus, nunc vero etiam salutem.* Ep. Fam. 9. 2. In his present obscurity, he wrote his book of Oratorial Partitions. Another fruit of his leisure was his Dialogue on famous Orators, in which he gives a short account of all who had ever flourished either in Greece or Rome. The conference is supposed to be held between Brutus and Atticus in Cicero's garden at Rome, under the statue of Plato, whom he usually imitated in his manner of dialogues.

A domestic occurrence in the latter part of his life, as late as his 61st year, has impressed perhaps the only stain that can be fixed upon the bright purity of his private character. This was his divorce of his wife Terentia, and his immediately subsequent marriage with his rich, beautiful, and youthful ward Publelia. As he was involved in debt, the possession of Publelia's fortune, rather than of her person, may be supposed to have been his motive. In whatever light the match be regarded, the disparity of their years, the relationship of ward and guardian, and the separation from one who had so long been his partner, would make us wish that this part of his history had not existed. Yet his conduct was not without one apology, which, if it does not excuse, at least in some degree extenuates the proceeding. Terentia was an imperious, turbulent, and expensive woman. He had borne her perverseness in the vigour of health, and in the flourishing state of his fortunes; but in declining life, and when he was soured by mortifications from abroad, the want of domestic quiet was no longer tolerable. The divorced Terentia, we are told by Valerius Maximus, lived to the age of 103 years; and, according to St Jerome, married three husbands after Cicero, so that the separation seems neither to have affected her health nor spirits. The death of his daughter Tullia in childbed, soon after his second marriage, gave a deep wound to his sensibility; and the behaviour of his young wife, who rejoiced in the removal of her step-daughter as a rival in his affections, and whom he was at length obliged to repudiate, deprived him of his chief domestic comforts.

The conspiracy against Cæsar was concerted without Cicero's knowledge, yet the removal of an usurper was thought so conformable to his public principles, that Brutus, after the deed, waving his bloody dagger, called on the name of Cicero, and hailed him on the restoration of liberty. Cicero was well inclined to justify the action, but the turn given by Anthony to the minds of the people, deterred him from more than some general attempts to restore public concord, and at length induced him to retire into the country, where he resumed his literary pursuits. During this period he wrote his Treatise on the Nature of the Gods; his Discourse on Divination; his Dialogue on Old Age; and his Treatise on Friendship. He was also employed on a history of his own times, or rather of his own conduct, which it does not however appear that he ever intended for publication. The arrival of young Octavian in Italy, however, opened to him a prospect of serving the state, and recovering his own consequence. The crafty youth was able to persuade the aged orator that his intention was to establish the republican constitution, and become the faithful servant of the senate. Cicero, who never loved nor trusted Anthony, as soon as he thought himself sufficiently protected, by the quarrel between him and Octavian, promoted the most hostile measures against the former, and the most honourable decrees in favour of the latter; and he pronounced those famous Philippics, which, while they proved him fully possessed of all the powers of eloquence, procured him a most implacable foe. The subsequent reconciliation of the two rivals, the formation of the second triumvirate, and the triumph of their party in Italy, drove Cicero again to his retreat. The last thing which the triumvirate adjusted was a list of the proscription of their enemies. Cicero was at his Tusculan Villa with his brother and nephew when he first received the news of the proscription, and of their being included in it. It had been the design of the triumvirate to keep it a secret, if possible, till the moment of execution; but some of Cicero's friends found means to give him early notice, upon which he set forward presently with his brother and nephew towards Astura, the nearest villa which he had upon the sea-side, intending to transport themselves directly out of the reach of their enemies. But Quintus, being wholly unprepared for so sudden a voyage, resolved to turn back with his son to Rome, in confidence of lying concealed there till they could provide money and necessaries for their support abroad. Cicero, in the meanwhile, found a vessel ready for him at Astura, in which he embarked; but the weather being stormy and adverse, he only sailed about two leagues along the coast, and landing at Circaeum, spent a night near that place in great anxiety and irresolution, uncertain whether to fly to Brutus, Cassius, or to one of the sons of Pompey, and even meditating suicide. The importunity of his servants at last prevailed with him to sail forward to Cajeta, where he went again on shore to repose himself in his Formian Villa, about a mile from the coast; weary of his life, and declaring that he would die in that country which he had so often saved. Here he slept soundly for several hours, till his servants forced him into his litter or portable chair, and carried him towards the ship through the private ways and walks of his woods, having just heard that soldiers were come into the country in quest of him, and not far from the Villa. As soon as they were gone, the soldiers arrived at the house, and perceiving him to be fled, pursued immediately towards the sea, and overtook him in the wood. Their leader was one Popilius Lænas, a tribune of the army, whom Cicero had formerly defended and saved in a capital cause. As soon as the soldiers appeared, the servants drew their weapons and prepared to defend their master to the last; but Cicero commanded them to set him down and to make no resistance; then, looking on his pursuers, with a calm firmness, stretched forth his head out of the litter, and bade them do their work. They cut off his head and both hands; and Popilius, charged with the horrid burthen of that head which had preserved his own, set out with it to Rome, as the most agreeable present which he could bear to Anthony. Anthony caused the head to be fixed upon the rostra between the two hands, a spectacle which drew tears from all virtuous citizens. The death of Cicero was indeed regarded as the death-blow of the republic. Anthony regarded it as such, and declared the proscription at an end. He was killed at the age of sixty-three years, eleven months, and three days.

Cicero's literary character has come down to posterity in the double light of an orator and a philosopher. As an orator, he has no rival in antiquity but Demosthenes. In comparing them, Quinctilian has given him the preference; while Hume, Fenelon, and, generally speaking, the majority of moderns, seem to regard the Greek master of eloquence to have come nearest to the idea of perfection. In comparing geniuses of so high a description, the preference is rather an affair of taste than demonstration; and perhaps it is of more importance to appreciate the distinctive characters and particular merits of each, than to attempt that decision of pre-eminence which will always be a problem. To the clear, close, and rapid simplicity of the Greek orator, we may contrast the copious, inexhaustible variety, the deliciousness and magnificence of Cicero's eloquence. The logic of Demosthenes is irresistible, the fire of his enthusiasm is the light of conviction, his progress to the point of attack is more vehement and direct. Cicero's manner has more preparation; he studies every possible resource. The tactics of the Greek orator have been compared to an assault upon a city by storm, and Cicero to a besieger making his approaches in due form, constructing his parallels, cutting off the issues of his enemy, and surrounding him at all points. Much has been written to prove that these characteristics of their respective eloquence, arose necessarily out of the circumstances of the times in which they lived, and the people whom they addressed. That the lively and shrewd Athenians, would not have listened to the luxuriant ornaments of Cicero's style; and that the Romans were too proud to have suffered the bold and blunt appeals of Demosthenes, too grave to have required the electrifying shocks by which the Greek orator found it necessary to fix their volatile attention. Those speculative theories, however, are by no means satisfactory. The Roman senate were, at least, as shrewd judges of style, as likely to be fond of unadorned and nervous simplicity, as the mob of Athens; and if the Roman character, in general, was more phlegmatic, it was more likely, than the Greeks, to have required the electric vehemence of Demosthenes. The difference of the orators lay in their genius, perhaps, more than their circumstances. Whatever Cicero might have been at Athens, it is difficult to conceive, that Demosthenes in the forum, or before the conscript fathers, would have been equally effective as when he fulmined over Greece. It seems indeed to be generally conceded, that, for pleading to carry conviction, Demosthenes is supreme. Could we suppose them both alive at this moment, and both equally ardent and instructed in some mighty public cause which required to be supported by eloquence, could we suppose *all* the enlightened spirits who have ever perused and felt the force of their works, to be named as judges in selecting the one or other to plead that cause, *most probably* the greater number of suffrages would be that the office of pleader should be assigned to the Greek. This, if admitted, might appear at once to decide the point of superiority on the side of Demosthenes. But Demosthenes and Cicero, it should be remembered, are now submitted to posterity, not merely as pleaders, but as fine writers; and another question arises, from which of the two will the mind of their readers derive the greatest degree of pleasure? In this view of their merits, the greater variety of Cicero's subjects, the richer luxuries of his diction and imagery, the intermixture of a finer, more pathetic, and philosophical spirit in his orations, give them a value independent of the pleading which they contain, or the models of argumentation which they exhibit. Had they been opposed to the terser eloquence of Demosthenes, before an audience assembled to decide rigidly on a point in dispute, those graces *might* possibly have furnished an inferior pleading; but to posterity they afford a richer treasure of literature, and perhaps altogether a nobler exhibition of the genius of one man. The manner of Cicero, we are told, fell into discredit in the succeeding age. Some considerable authors, with Sallust at their head, struck into a closer and more sententious style of writing, pretending to emulate the purity of Demosthenes and Thucydides, though they were far from reaching it. Even in his own time, we find him replying to those censurers who reproached him for want of Attic simplicity. Brutus was of the number; although, it is clear, from Cicero's appeal against their criticisms, that what they meant by simplicity, was only a naked and starved diction, devoid of all legitimate eloquence. Under the age of Augustus, political causes contributed to debauch the Roman taste; and under that reign, it became fashionable to decry the taste and manner of Cicero. Virgil, in giving the province of eloquence to the Greeks, did not chuse to offend his patron by a compliment to Tully. The two Asinii Polliones, father and son, distinguished orators of the same age, attacked his abilities even with acrimony, and the younger wrote a book to prove that his father excelled Cicero. Augustus was himself a dabbler both in prose and verse, and probably contributed to bring a corrupted style into fashion. Mecænas was an Anticiceronian both in theory and practice. The character of authorship, which some of the succeeding Roman emperors affected, and the danger of either departing from their manner of writing, or of expressing their thoughts in plain language, together with the swarms of Greek rhetoricians who took pains to deride the eloquence of Cicero, gradually debased the taste of the world, till Quinctilian arose and reformed it, at least in as far as the reputation of Cicero was concerned, whose character as an orator he restored to its true light, concluding with these words, *Hunc ergo spectemus, hoc propositum nobis sit exemplum. Ille se profecisse sciat cui Cicero placebit.*

The philosophical works of Cicero were composed in the stormy period which drove him to retirement, between the breaking out of the war of Cæsar and Pompey, and his own death. One half of them has perished by the ravages of time. They formed a complete course of the philosophy of the Greeks, which had followers and admirers at Rome since the time of Lælius, but few expounders. Cicero was the first who had intelligence and enterprize sufficient to exhibit it in all its systems to his countrymen. Its subjects were so new to the Romans, that their language had not terms for the abstract ideas of the Greeks; and it was he who first created that metaphysical language, of which a portion disentangled from the jargon of the schools still exists in modern philosophy. He commenced with his book entitled *Hortensius*, which has been lost. Next followed his *Academic Questions*, in which he followed the doctrines of Plato. The object of his five dissertations, called the *Tusculan Questions*, is to discover the most essential means of happiness, which he reduces to five. The contempt of death; patience in affliction; firmness in different trials of life; habitual controul over the passions; and the persuasion that virtue ought to seek for no recompense but from itself. This philosophy is confessedly borrowed from the Academy, and the Portico; but it is highly embellished by his eloquence. The most pleasing parts of his work, are where he enters on the natural proofs of the immortality of the soul, and the future rewards of a virtuous life.

In his Treatise on the Nature of the Gods, his object seems to be to prove and justify a superintending providence. To find a man unenlightened by revelation, devoting the ripeness of his mind to such exalted subjects, may well surprise us; and our admiration must be complete, when we find, that, while he stands the advocate of religion, he is so little tainted with superstition. In his book on Divination, he makes every species of ancient imposture and superstition pass in review. His *Scipio's Dream*, is a fancy piece, built on the Platonic doctrine concerning the soul of the world, and the state of human souls after death. His work *De Finibus*, on moral ends, contains an account of the opinions of the several Grecian sects upon this subject, and discusses their leading arguments. His work *De Officiis*, may be properly termed the Heathen whole Duty of Man; a piece, which even Christians cannot read without advantage. His dialogues, entitled *Cato and Lælius*, the first treating on old age, the second on friendship, are extremely elegant and agreeable pieces of moral writing. His Epistles, perhaps, more justly merit the appellation, than any of the same importance, as documents of history, and models of composition, which have ever appeared. His work *De Legibus*, which explains the grounds of jurisprudence, is incomplete. His treatises *De Republicâ*, and his *Œconomics*, have unfortunately been lost.

To the list of his writings, should be added his rhetorical treatises *De Oratore;* his book *De Claris Oratoribus;* and his *Orator*, addressed to Brutus. See *Plutarch*. Middleton's *Life of Cicero*. *Ciceronis* Opera. (n)

CICHORACEÆ. See BOTANY, p. 79.

CICHORIUM, a genus of plants of the class Syngenesia, and order Polygamia Æqualis. See BOTANY, p. 289.

CICINDELA. See ENTOMOLOGY.

CICUTA, a genus of plants of the class Pentandria, and order Digynia.

CID. See SPAIN.

CIENFUEGIA, a genus of plants of the class Monadelphia, and order Dodecandria. See BOTANY, p. 268.

CILICIA, was an ancient dynasty of Asia Minor, extending from the 36th to the 40th degree of north latitude; bounded on the east by mount Amanus, which divided it from Syria; on the south by the Mediterranean sea; on the west by a chain of mountains, which separated it from Pamphylia and Pisidia; and on the north by Isauria, Cappadocia, and Arminia Minor.

If we be allowed to prefer any one of the discordant accounts, found in ancient history, respecting the aborigines of this country, we would say, that it was peopled by Tarshish the son of Javan, from whom it was, at first, denominated Tarsis, and its metropolis Tarsus. The descendants of this patriarch are said to have kept possession of this region till after the Trojan war, when Cilix, a brother of Cadmus, and a native of Phœnicia, migrated with a daring colony of his countrymen, into Cyprus; and, in the restless ardour of adventure, leaving that island, invaded Tarsis, and deprived the inhabitants of their independence, and the country of its name, which, from its conqueror, was now denominated Cilicia. Several bands, both from Greece and Syria, afterwards imitated this example, and, settling in the same country, were blended with the ancient inhabitants. The names of the kings who succeeded Cilix, and the actions which they performed, cannot arrest our attention, till the country willingly yielded to the power of Cyprus, and its sovereigns resigned their independence to the Persian court. Cilicia, however, enjoyed the shadow of royalty, till the reign of Artaxerxes Mnemon, who stript it of its tributary kings, reduced it to a province of the Persian empire, and in this state of degradation it remained, till the Persian empire was extinguished by Alexander. At the death of that monarch, Cilicia became a part of the dominions of Seleucus, under whose descendants it remained, till it was subjected to the Romans, by the arms of Pompey. It was, however, under the proconsulship of Cicero that the country was completely subdued, and was formed into two divisions; the eastern part being denominated Cilicia Campestris, and the western Cilicia Aspera. The Romans, with their accustomed policy, claimed the former, which was by far the most valuable, as a province; but allowed the latter to boast of its own kings, who were, however, dependent upon the senate. But Vespasian deprived even this division of the last appearance of independence, and divided again the whole region into Cilicia Prima, formerly distinguished by the epithet Campestris. Cilicia Secunda, comprehending the maritime part of what was before denominated Aspera, and Isauria, which included the interior of the same district. In this state it remained, till the Roman territory was divided under Honorius and Arcadius, when Cilicia naturally followed the fortunes of the eastern empire. When the eastern empire proved, at last, unable to preserve its boundaries from violation, Cilicia was torn from it by its bold invaders, and, after experiencing all the vicissitudes which have since agitated Asia Minor, it now forms a part of the extensive province of Caramania.

The whole region of Cilicia was surrounded by rocky and precipitous mountains, which defended it like a wall, and left it accessible only by three narrow passes, emphatically called the gates of Cilicia, one leading from Syria, a second by mount Amanus, and a third by mount Taurus. The eastern division, formerly denominated Cilicia Campestris, was, as the name imports, a level and a beautiful country, abounding in fruits and grain. The western division, called Cilicia Aspera, or Trachæa, was rough, stony, and mountainous, but compensated for its sterility, by producing excellent horses, which are still in great repute. The air, in the interior, is favourable to health and longevity; but on the sea-coast diseases, of a dangerous nature, frequently prevail. The principal rivers which fertilize Cilicia, as they roll to the Mediterranean, are the Selinus, the Calycadmus, the Lamus, the Cydnus, the Serus, the Pyramus, and the Pinarus. The metropolis of this dynasty was Tarsus, now Tarasso, situated upon the Cydnus, and celebrated, in ancient times, as the rival of Athens and Alexandria, in every department of art and of science; and still venerable as the birth place of St Paul, who, when fame shall be conferred in proportion to the blessings of knowledge, of civilization, and of happiness, which the world has received from its benefactors, shall be accounted the first of human characters. It would be inconsistent with our plan to enumerate all the cities of this region, which are mentioned in ancient history: we may add, however, that Soli, built upon the sea-coast by the Greeks and Rhodians, who, mixing together, lost the purity of their native languages, is said to have given occasion to the term *solecism*, which is still applied to an impropriety of expression. Anazarbum, situated on the Pyramus, was the native city of Dioscorides: Issus, now Aisse, on the borders of Syria, was famous for the battle of that name, fought between Alexander and Darius, and for the defeat of Niger by Severus: And Sarpedon is well known by the famous temple which it contained, consecrated to Apollo and Diana. (M)

CIMBRI. See GERMANY.

CIMEX. See ENTOMOLOGY.

CIMICIFUGA, a genus of plants of the class Polyandria, and order Tetragynia. See BOTANY, p. 238.

CIMMERII. See SCYTHIA.

CIMON. See ATHENS, p. 24.

CINALOA, or SINALOA, a province on the western coast of New Spain, in the intendancy of Sonora; extends from the Rio del Rosario, to the Rio del Fuerté. It contains five towns, 92 villages, 30 parishes, 14 farms, and 450 cottages. In 1793, the number of tributary Indians amounted to 1851. The following are the principal towns of the province, viz.

Culiacan, formerly Hueicolhuacan. Population, 10,800.

Cinaloa, or the Villa de San Felipe y Santiago. Population 9500. W. Long. 107° 56′. and N. Lat. 25° 57′.

St Rosario, situated near the rich mines of Copala. Population 5600.

Villa del Fuerte, or Montesclaros. Population 7900.

Los Alamos, which is the residence of a *disputacion de Mineria*. Population 7900.

The statistical account of this province will be given, with more propriety, under the article SONORA. (W)

CINCHONA, or, as it is commonly called, *Peruvian Bark*, is obtained from several species of the genus Cinchona, which belongs to the class Pentandria, order Monogynia, and to the natural order *Contortæ*. Twenty-five species have been described by the Spanish botanists as natives both of North and South America. Our observations, from the imperfect nature of the information which we possess, must be confined to the genus, and must not extend to the species. The cinchona is a tree which is found only in mountainous tracts, where it grows to the thickness of a man's body. The Spaniards have never yet attempted to cultivate it, but merely strip the natural trees of their bark; a practice which must ultimately destroy the genus, as they always die after being deprived of their bark. This operation is performed in the dry season, which is from September till November. The bark being well dried in the sun, is packed up in skins, so as to form bundles of one hundred, or one hundred and fifty pounds weight. These packages are called Lerdone by the Spaniards: they contain all the species, which are afterwards sorted according to their quality.

Three kinds of bark are in use as a medicine in Europe. Of each of these we shall give a brief account, and afterwards conclude with a statement of the modes of preparation most commonly employed. The following are the varieties enumerated by the Edinburgh College.

1. Common bark.
2. Yellow bark.
3. Red bark.

1. *Common bark.* Several varieties of this species of bark are brought to Europe; the quilled variety from Loxa, and the flat from Guanaxo, are the most remarkable. The former of these comes over in pieces four or five inches long, rolled up very thin, externally of a grey-

ish brown, internally (when fresh broken) of a bright cinnamon colour. Its fracture is clean and even. Its taste is bitter and astringent, its smell peculiar but aromatic. The latter variety is imported in flat, coarse, and thick pieces; and still farther differs from the quilled bark in having a much darker colour externally. In every other character it corresponds with the former. Both are said to be equally efficacious.

2. *Yellow bark.* This is less rolled than the quilled bark; its pieces are also larger and thicker. It has a much deeper red colour. Its fracture is fibrous, and in powder it is much paler than in its entire state. Its taste is more powerful, though the smell is weaker, than the common bark. Its active principles are more abundant. This bark has been only introduced into use since the year 1790, by Mutis, who considers it to be the only variety which possesses a real febrifuge quality.

3. *Red bark.* This variety is sometimes rolled, but more commonly is in flat, thick, large pieces. It is heavy, firm, and dry. It has a smooth fracture. It is composed of three layers. When powdered, it has a reddish colour. It is more bitter and astringent than the common and yellow bark.

All the varieties of cinchona are highly valuable, and are consequently liable to be adulterated with various substances. It is therefore necessary to attend, in selecting this drug, accurately to all of its characters.

Cinchona has been long known as a medicine in Peru, where the natives are said to have adopted its use, from observing animals recur to it. Whatever may have been the source of its first employment, it was not tried by Europeans until the year 1640, when the Countess of Cinchon, the wife of the Spanish viceroy, was cured of the ague by means of it. It therefore derived its present name from her. It has also been called Jesuits bark, from the exertions made by these disciples of Loyola to introduce it. As it usually happens on the first appearance of any novel remedy, considerable opposition was made to it by several eminent physicians; but its efficacy soon overcame the groundless clamour which had been excited.

Probably no vegetable substance has undergone so many analyses, by the most distinguished chemists of Europe, as the different kinds of cinchona have been subjected to, and yet little positive knowledge has been obtained of its constituent parts. The following are the most important results that have been obtained respecting the composition of the different varieties of cinchona: To enter into a minute detail of the analyses of the individuals would far exceed our limits. The bases of all the varieties is *ligneous fibre*, combined with which there are several other principles which may be extracted by means of proper solvents. In all the varieties, they correspond, except in the proportion and consequent activity. A cold infusion of common bark has a bitter taste and slight peculiar odour; when a common heat has been employed, a larger quantity of the active principles is dissolved, but the complete solution ceases, on cooling, as is indicated by the turbidity of the fluid. A decoction of this bark has a very astringent taste, and a deep brown colour. On cooling, its transparency is destroyed, and a precipitate is deposited, that is soluble in alcohol. Much heat destroys all the active principles of the bark by decomposition. Alcohol, in all its modifications, is a powerful solvent of the active principles of cinchona. A solution of ammonia is also a powerful solvent of them. Vinegar acts very imperfectly on them.

The agency of the different menstrua on the red and yellow varieties of the cinchona, produces apparently the same results as on the common or pale bark, varying, however, very considerably in degree; the red being more powerful than the common, and the yellow still more so than the red.

It is an object of considerable importance, as well as of curiosity, to determine exactly the proportions in which the different principles exist, in the varieties of bark, as well as the relations which these principles have to their efficacy as a medicine; but, unfortunately, the difficulties which are opposed to the analyses of such fleeting and delicate substances, as the principles of vegetables, render this desire unavailing, at least in the present state of science. The greater solidity of the principles of bark in hot water and in alcohol, would induce a belief of its being a resin; while, on the other hand, their partial solidity in cold water, and their decomposition even by a moderate degree of heat, are characteristic of the extractive principle.

The effects of chalybeates on the infusions of Peruvian bark, indicate the presence of an astringent matter, which seems to be intimately connected with the substance extracted by heated water or by alcohol. The addition of a solution of the sulphate of iron to the infusion, strikes a dark olive green colour; a deeper shade of the same colour is produced by this salt in the decoction or tincture. From this fact, it has been inferred, that tannin is present, and, consequently, that a precipitate would be produced by a solution of gelatine. This effect, however, is only induced in some varieties of the Peruvian bark; there being others, the infusions of which are not, in the slightest degree, affected by the addition of gelatine, but yield a precipitate on the addition of tannin. These singular phenomena have given rise to a very absurd hypothesis of Seguin, in which he ascribes the agency of Peruvian bark to the presence of gelatine.

Dr Duncan ascribes these effects to a new agent, which he calls cinchonin. Vauquelin has made extended experiments on the different species of cinchona, but they are of less value than they would have been, had he detailed the specific characters of each. Mr Murray has found, “that the watery infusion of the pale bark is not sensibly precipitated either in gelatine or tannin; that of the red bark is not precipitated by gelatine, but gives a copious precipitate with tannin; and that of the yellow is rendered turbid by gelatine, and precipitated copiously by tannin.” It is vain to throw out conjectures, as to the nature of this substance, until farther facts be determined, on which we can rest with greater certainty.

Vauquelin has determined the presence of a peculiar acid, to which he gives the name of *kinic* acid, in some varieties of the bark.

The active principles of bark are rendered more soluble in water by the acids, the alkalies, and some of the earths, more especially magnesia.

Much diversity of opinion prevails among medical men respecting the relative efficacy of the three kinds of bark which we have enumerated. The red bark, when first introduced into English practice, in consequence of a Spanish vessel, freighted in part with it, being taken in the year 1779, was tried in several of the London hospitals, and was then, as is usual with every new remedy, extolled to the skies; but its reputation has given way to that of the yellow bark, which is *now* generally considered to be most efficacious.

The preparations of bark, which are admitted into the British Pharmacopœias, are, the decoction, the extract, the infusion, the tincture, and the compound tincture. The powder is unquestionably the most efficacious when the patient's stomach can bear it; and the other preparations must be resorted to when its use is inexpedient. Of these, the extract appears to be the least calculated to do any good. The practitioner must be guided, in a great measure, by the habits and delicacy of the patient. See MEDICINE.

It is utterly impossible to say in what manner the Peruvian bark acts on the human constitution. In general, it is considered tonic, antiseptic, and astringent, and it may possess all of these qualities in a very pre-eminent degree; but still no clue is furnished by them to develope the mode in which it acts in the cure of disease. Thus, for example, every physician is well acquainted with the symptoms of intermittent fever, but there are few sufficiently daring to arrogate any decided knowledge of the causes of these symptoms; every practitioner has some hypothesis of his own, but if he be a man of common sense, he will never make that the basis of his practice. In like manner, experience has shewn, that Peruvian bark almost universally cures this fever; but how this cure is induced, it is impossible to determine, until we are assured of the nature of the diseased action which it overcomes. The effects of bark are very powerful; and it is a very remarkable fact, that its action is imperceptible on the human constitution. The only effects of an overdose, are headache and nausea. Whatever difference of opinion may prevail respecting the mode in which the Peruvian bark produces its effects, there is no doubt of the very decided character of these effects. In intermittent fever it was first used, and what is very rare in the history of medicine, still maintains its pre-eminence over every other remedy in general application. Experience too has taught almost the whole host of medical men, that it may be administered very safely in large quantities, in all stages of the disease, without any other preparation than that of previously evacuating the stomach by an emetic, or by a cathartic. It has been supposed most useful when exhibited before the recurrence of the paroxysm. It may be given even in the hot stage, though it is then more liable to induce nausea. But the more common mode of practice is to administer it during the interval of the paroxysm. Frequently very smart attacks of intermittent fever have been cut short by the timeous use of this medicine. The usual dose is from one to two scruples every fifth or sixth hour during the intervals of the paroxysms, and this should be continued for some time (which must be determined by circumstances) to prevent a relapse.

In remittent fever, particularly the bilious remittent of hot climates, even where the remission is very obscure, bark may be administered with great freedom, and very generally with much advantage.

It is given in diseases of debility, such as typhus, cynanchi maligna, in passive hæmorrhagies, confluent small-pox, in dysentery. It is also employed in scrofula, ill-conditioned ulcers, &c. In the first of these classes it does not appear so beneficial as wine, from the weak state of the organs of digestion. When the patient is convalescent, it is considered more useful.

Bark has been used very freely in rheumatism, particularly among the London practitioners, and very generally with advantage. It is the object of another article to enter more fully into the uses of this very valuable remedy.

Half a drachm is the usual dose; but, under particular circumstances, the quantity may be very much augmented. Two ounces have been taken, in urgent cases, in the course of twenty-four hours.

The powder, as before hinted, is the most efficacious form in which it may be administered, either mixed up with water, milk, jelly, or any other simple vehicle, or combined with some stimulant aromatic matters. It sometimes excites vomiting and purging, which must be corrected by the usual means. See Thomson's *Chemistry.* Murray's *Materia Medica. Pharmacop. Collegior. Lond. Edin.* &c. *Practice of Physic,* (passim) *Thomas* and *Cullen.* See also MEDICINE. (C. M.)

CINCINNATUS. See ROME.

CINERARIA, a genus of plants of the class Syngenesia, and order Polygamia Superflua. See BOTANY, p. 302.

CINNA. See ROME.

CINNA, a genus of plants of the class Monandria, and order Digynia. See BOTANY, p. 183.

CINNAMON. This well known spice is the bark of the *Laurus cinnamomum*, which is cultivated both in the spice islands and at Cayenne, though most abundantly in the former, whence almost the whole of the cinnamon for the European market is brought. The characters of the *laurus cinnamomum* are given under the article BOTANY. It belongs to the class Enneandria, order Monogynia, and to the natural order Oleraceæ.

Captain Perceval has given the fullest account of this plant that has ever met our eye, and the following account is substantially derived from his History of Ceylon. The cinnamon gardens are within half a mile of the fort of Columbo in Ceylon. They extend over a surface of more than 15 miles, which is traversed by various roads. There are also plantations of the shrub at Madeira, and Point de Galle. It thrives best in a loose white sand. It has a slender trunk, rises to the height of from four to ten feet, innumerable branches shoot from the stem, and give it the appearance of the Portugal laurel. The wood is light and porous like that of the osier. It is used as fuel. Shoots spring up from the roots in immense profusion. The leaves, when they first burst, have a beautiful scarlet colour; they then become green, and have both the taste and the smell of cloves. The blossom is white, and has no smell. The fruit resembles an acorn. It is ripe at the end of autumn, when oil is obtained by bruising and boiling it. The natives anoint themselves with the oil, which is skimmed off, and they also mix it with cocoa nut oil, and burn it in lamps. During all audiences with the sovereign of Candy this oil is burnt. When the trees become too old, they are cut down, and their places are soon occupied by young shoots, that rise from the roots in vast profusion. Formerly, many of these young twigs were cut as sticks, which are highly prized; but this is now prohibited.

The natives divide the true cinnamon into four classes. 1. *Rasse curundu*, or honey cinnamon, which is known by its broad thick leaves. 2. *Na icurundu*, or snake cinnamon, which is also known by the size of its leaves. 3. *Capuru curundu*, or camphor cinnamon, which is very inferior to the former too. The root yields camphor by distillation. 4. *Cabatte curundu*, which is harsh and astringent. Its leaves are also smaller. There are other species of cinnamon, which are entirely rejected by the servants of government.

Originally the cinnamon tree was wild, but one of the Dutch governors raised it artificially. The cultivation was neglected by his successors, until the capture of Ceylon by the British. The plantations are now in regular rows, which facilitates the gathering of the spice.

The bark may be collected at any period of the year; but there are two seasons at which the regular harvests are gathered in. The first of these takes place between the months of April and August, and is called the great harvest; the second lasts only one month, from the end of November to the beginning of January. The whole barking is carried on by a particular class of the natives, called Schjalias by the Dutch, and Choliahs by the English. These are again divided into different ranks, and are all subordinate to a man, that receives the title of Capitain Canaillé. Every district furnishes a quantity of cinnamon proportionate to its extent, and the number of its inhabitants.

The branches which are three years old are lopped off; the epidermis is scraped off with a knife, having one side concave, and the other convex: the true bark is then ripped up, loosened by the convex side of the knife, and separated from the wood. The smaller portions are then put into the larger. They are then dried in the sun. When the drying is complete, the cinnamon is packed into bundles, which weigh about 30 pounds. These bundles are bound with bamboo twigs. They are then marked and numbered. These different processes are performed by different classes of the choliahs.

When the cinnamon is brought to Columbo, previous to its shipment for Europe, it is examined by the surgeons in the Company's service in rotation; and this is a most painful duty, as the only test is the taste. The continued chewing of this pungent substance, excoriates the mouth in spite of the utmost precaution. Experience has shewn, that the evil effects of the chewing is best alleviated, by occasionally eating bread and butter.

The best cinnamon should not be thicker than thick writing paper. It should be rather pliable, of a yellowish colour. It should have a sweet taste, and not be so pungent as to produce pain. The inferior kinds are thicker, darker, more pungent, and bitter. After the examination at Columbo has been finished, and the different kinds of cinnamon separated, they are packed into bundles four feet long, and weighing eighty-five pounds, five of which are allowed for waste in the passage. The bundles are wrapped up in coarse cloth made of hemp, or of the fibrous part of the cocoa nut tree, and the interstices are filled up with black pepper. This latter practice is said to improve the flavour of both spices.

The refuse is put into tubs in quantities not exceeding one hundred weight, and being covered with water, they are allowed to macerate for six or seven days. A small portion of the incumbent liquor is distilled from a copper alembic into glass vessels. One tub requires twenty-four hours for distillation. The fluid which passes over has a milky appearance, the oil floats on the surface, from which it is skimmed off, bottled, sealed, and locked up. The finest has a bright gold yellow colour, and the flavour of cinnamon in a very high degree.

From the distillation not having been carried on since the British have been masters of the colony of Ceylon, the price is risen from three-fourths of a Dutch ducat to 10*l.* or more per pint.

The Dutch were accused of deteriorating their cinnamon, by substituting the distilled bark, and cassia bark; but this fraud is easily distinguishable.

Captain Perceval considers the cultivation of this valuable spice to be susceptible of much improvement.

Cinnamon is one of the most agreeable of the spices. It is valuable in household œconomy, and the oil is also useful to the medical practitioner. It is stimulant, and may be employed in cramp of the stomach, &c.; but it is chiefly employed to conceal disagreeable odours and taste in other drugs. See Perceval's *Account of Ceylon* (C. M.)

CINTRA. See BRITAIN, p. 696, and ESTREMADURA.

CIPOLI. See NEPAUL.

CIRCÆA, a genus of plants of the class *Diandria*, and order Monogynia. See BOTANY, p. 93.

CIRCARS. See INDIA.

CIRCASSIA, a country of Asia, situated between 40 and 50 degrees E. Long. and between 45 and 50 degrees N. Lat. It is bounded on the north by the river Don; on the east by the Caspian Sea, and the mouths of the Volga; on the south by Mount Caucasus, and the Black Sea; and on the west by part of the Black Sea, and the Lake of Azof. The face of the country is pleasantly diversified with mountains, valleys, woods, lakes, and rivers, and in respect at least to its natural state, the soil is far from being devoid, in a reasonable degree, of the elements of fertility. The defects that in this particular present themselves, appear to be the consequence chiefly of a want of proper culture.

General aspect.

Manners of the inhabitants.

Circassia is inhabited by a warlike race of people, who having expelled or subjected to their dominion the greater part of those tribes, which at earlier periods had obtained possessions in it, spread themselves by degrees over the whole region. They now constitute one of the most considerable of the seven nations inhabiting the Caucasian mountains, and the territory in their environs. Among this people, there seems to be established a complete system of feudalism, not unlike that formerly exercised, though with still greater severity and cruelty, by the German knights, in Prussia and Livonia. The princes and nobility here, accordingly, may be considered alone to constitute the nation, who, both in their intercourse with one another, adhere rigidly to the principles of a feudal subordination, and are guided by the same views in the treatment of their subjects. The latter almost uniformly are captives, subjugated in war, but from adopting the language, and accommodating themselves to the wishes of their conquerors, they are usually treated with lenity. The chiefs and knights among the Circassians pursue ordinarily no other business or recreation, than war, pillage, and the amusements of the chase. They live a lordly life, wander about, frequent carousals, and concert and undertake freebooting, or military excursions. The knights keep the lower classes of the people in a due state of order and submission, but are themselves no otherwise subject to the chiefs or princes, than by the obligation of yielding their personal service in war. Vassals, or boors, are considered as hereditary property, and are bound to yield an implicit obedience to their masters, holding, indeed, at their disposal, not barely their possessions, whatever these may be, but even their persons, and their lives. Few instances, however, occur of their being actually sold into bondage; for generally, though not restrained by any positive laws, the prince considers it his interest to secure the affection of his subjects, and entitle himself to their fidelity in war, by a liberal and benevolent conduct. The peasantry, consisting of vassals naturalized, and slaves more recently taken in war, who fall afterwards into the same class, plough the land with large ploughs drawn by six or eight oxen; they attend to the pasturage of their flocks, carry the necessary timber and fuel from the forest, build the houses, get in the harvest, and make hay, which during winter is commonly consumed on the spot. In the time of harvest, they are assisted in their labour by the women and grown up girls. When in the course of such occupations, these people have occasion to remove to some distance from the villages, they immediately construct huts, by joining poles, which they cover with branches of trees and long grass, so that they almost resemble hay-stacks. It is in huts of a construction somewhat similar to these that the princes encamp, when in the course of their constant expeditions, and equestrian rambles, they are obliged at any time to remain for a season stationary.

It is an established usage here, that each male of the peasantry is obliged to work three days at hay-making either for the prince or nobleman, to cut wood in the forest for three days, to carry both the hay and wood to their habitations, and for every bullock that he possesses to deliver a cart load or seven sacks of millet. A bridegroom of this class is under the necessity also of giving to the lord of the manor two cows and two oxen, in return for obtaining his consent to marry. The inhabitants of the mountains, consisting of several subordinate tribes, which the Circassian princes have succeeded in subjecting more or less to their authority, give, in general, for each family, only one sheep, or its value in felts, felt-cloaks, cloths, copper vessels, or other articles like these, of primary and indispensible use. Every boor who possesses sheep, whether his flock be large or small, is required during the encampment in summer, to contribute one sheep to the prince's household, who is thus enabled to maintain continual hospitality. It will be understood, that the Circassians, like the other Tartars in their vicinity, are accustomed to quit their towns in summer, and to encamp in the fields, occasionally shifting their stations, along with their flocks and herds. In these excursions, the women and children are carried in waggons, which are a kind of travelling houses, and drawn by oxen or camels; horses, notwithstanding the excellent breeds of these animals in this country, are never used here for draught.

Villages. The Circassians usually dwell in villages, which, partly on account of the increasing filth, partly from the insufficient security which they afford, or other causes, they from time to time desert. On such occasions, the dwelling places are demolished, the timber together with the household furniture is carried off, and what cannot be removed is burnt. The attention of the migrating horde is next directed to the choice of a convenient situation, on which to erect a new village. If the spot chosen for this purpose is at a distance from water, they conduct with much ingenuity a canal from the next rivulet, by means of it to obtain a supply of this essential article. The houses are built contiguous to each other, in the form either of a circle or square, and so that the inner space serves as a common large cattle yard, provided with only one gate, while it is altogether inclosed, and as it were defended by the circumjacent houses. The dwelling of the Usden, which is commonly large and commodious, and fitted up in such a manner as to afford to the occupants every desirable convenience, stands apart from this group of buildings, destined for the use of the general mass of the population. Small solitary houses, or rather square rooms, with every suitable appendage, are built here and there for the accommodation of visitors. This is all that occurs in these parts, in the character of public inns, which indeed are unnecessary among a people whose hospitality is such, that they will contend with each other who shall entertain any stranger that happens to come among them. There are also erected occasionally in the open fields, round huts of wicker work, containing a pit to be used as a place of retreat. In the vicinity of the village are placed stacks of hay and corn provided with a fence, and the corn that has been thrashed is sometimes preserved in large baskets, fixed for that purpose on the ground, and secured with covers.

Houses. The houses of the Circassians are constructed in the form of oblong squares, and are commonly not more than from four to five fathoms in length, and about nine feet broad. The walls are made of close wicker-work, carefully plastered on both sides with clay; and on the posts which support the walls the flat roof is placed, consisting of light rafters covered with long grass. The female and the male parts of the family commonly occupy their separate and appropriate parts in the dwelling; and, generally, both in their houses and villages, as well as in respect to their clothes, diet, and other matters of domestic or individual economy and arrangement, much attention is paid to neatness, cleanliness, and order. **Dress.** The dress worn here by the men, is neat, light, and becoming. Above the lower part of it, which is made of a sort of light stuff, persons of distinction wear sometimes a short rich waistcoat, as it were to supply the place of armour, and this either with or without a great coat. The upper dress, consisting either of cloth or other strong woven stuff, is somewhat shorter than the under garment; the sleeves are slit open, and frequently bordered with furs. The breeches are provided with knee-straps, and the seams bound with small lace or embroidery, which the women very skilfully manufacture of gold and silver threads. The upper garment is regularly furnished with a small embroidered pocket on each side of the breast, for containing cartridges. The whiskers are suffered to grow; and on the head, which is shorn in the Polish fashion, there is worn an embroidered cap, quilted with cotton in the form of a melon, but occasionally lower, and, amongst the wealthy especially, ornamented with various gold and silver laces. It is a custom of this country, that the girls, between the 10th and 12th years of their age, are provided with laced stays, or a broad girdle made of untanned leather; which singular coat of mail, as they are obliged to wear it till their wedding-night, is among the common people tightly sewed round the waist, or in the higher classes fastened with silver hooks. The gordian knot thus formed, the bridegroom, at the time specified, undoes with a sharp-cutting dagger: a ceremony not unfrequently attended with danger. Over the shift the younger females wear a laced jacket, because the petticoat, which reaches to the ankles, is open along the whole front, and resembles that of a man; but married women dress in wide breeches. The cloaks worn by the women are longer than those, in other respects generally of a similar description, that are in use among the men. They are likewise frequently white; a colour of which those of the men never are. The head-dress worn in earlier years, consists of a simple cap, somewhat similar in form to that used by the males. This is usually of a red or rose colour, but varying as to richness and decorations with the rank of the parties. Under it the hair is turned up in a thick queue, which is covered with linen. This mode of dressing is continued till after the female has been delivered of her first child, when she begins to cover the head with a white handkerchief, drawn close over the forehead, and fastened under the chin. When females have occasion to leave the house, they wear a sort of wooden clogs, to keep their feet clean, and at the same time make use of mittens on their tender hands. Painting the face is considered as an indication of the want of chastity; but it is allowed to girls to dye the nails of their fingers with the flowers of the *balsamina*, which, in the language of the country, is known by the name of Kna.

When a prince, or Usden, pays a visit in full dress, he is arrayed in all his accoutrements and coat of arms, with sometimes also an additional jacket of mail. Those coats of mail are manufactured of polished steel rings, and imported partly from Persia, partly from Kubesha, to the nations inhabiting the Caucasian mountains. The helmet and the arm-plates, from the former of which a net of ringlets hang down as far as the shoulders, are manufactured of polished steel. In the girdle there are usually stuck a dagger and pistols; and the bow and quiver are fastened round the loins by straps. In common visits, the coat of mail is worn under the upper dress, the head is covered with an ordinary cap, and the only armour used is a sabre. Without the sabre, persons of wealth and rank never leave their houses; nor do they venture beyond the limits of the village, without being completely arrayed, and having their breast-pockets supplied with ball-cartridges. When persons of the lower classes do not carry a sabre, with other arms, they provide themselves with a strong staff, two arshines long, on the top of which is fixed a large iron head, and on the lower end a sharp iron pike, of the length of about eighteen inches. This sort of dart they are accustomed to throw with much expertness. In their dress, generally, there seems not to be a very scrupulous adaptation among the people in this rank of life, between what they wear and the state of the weather, as it is not unusual to see them walking in the fields, dressed in their shaggy felt cloaks, called Burke, even in the warm days of summer. Instead of the material mentioned, these cloaks are sometimes formed of sheep-skins. They are fastened at the neck with a string; and, not being large enough to cover the whole body, they are necessarily turned round upon it, according to the state of the wind and weather.

Appearance of the inhabitants.

The Circassians are, upon the whole, a handsome race of people. The men, especially in the higher classes, are mostly of a tall stature, thin form, but Herculean structure; they are very slender about the loins, have a small foot, and uncommon strength in the arms. Some of these particulars in their conformation are not produced, however, altogether independently of artificial aid. It is a practice here, to compress the waist as much as possible from early infancy, for the purpose of securing that uncommon thinness between the loins and the breast, which is so prevalent a characteristic of the people of this country; and the unusual smallness of their feet, is no doubt the consequence, in some degree, of their forcing them, as they are accustomed to do, in the tightest manner within their Morocco slippers. Yet nature has not been unkind to this people. The males, for the most part, possess a truly Roman and martial appearance, though not entirely unmarked with traces indicative of the existence in some of them of a mixture of Nagai blood. The women, if not uniformly Circassian beauties, are yet generally well formed, have white skins, smooth clear complexions, beautiful black eyes, with dark brown or black hair, which they dispose elegantly in tresses on the two sides of the face, and regular features. The loveliness of their countenances, which are always in full view, it not being the custom here, as in most of the other provinces in these parts to have the face covered, is rendered yet more attractive, through the effect of their good humour, and the lively freedom of their conversation; and the *tout-ensemble* of an engaging appearance is favoured by the elegance of the head-dress. Altogether, the instances are few of an equal or a greater proportion of beauty being to be found in an unpolished nation. As in the case of the males, indeed, nature is, with a view to this object, assisted as far as may be, and seconded by art. According to the Circassian idea of elegance of form, a woman ought to have a very narrow waist, and the abdomen should protrude toward the lower extremities. What is deemed, in these respects, the most advantageous conformation for a woman, the girdle of chastity, before mentioned, may have its use in realising. Its efficacy is at least conspicuous in the astonishing smallness of waist that is here so prevalent. The shoulders indeed are, by the same means, rendered proportionally broad; but this defect is little thought of, on account of the beauty of the breasts, to which this treatment is equally subservient, and which it is the fashion of this country very much to expose. In order to promote the same end, the girls are very sparingly nourished, their whole allowance consisting simply of a little milk and pastry.

Rural and domestic œconomy.

As to their rural and domestic economy, it is to be observed, that the Circassians both cultivate the ground, and devote a considerable portion of their time to the rearing of cattle. Their principal species of grain is millet, of which are made cakes, hasty puddings, various kinds of pastry, as well as the liquor called by them hautkups. Maize, or Turkey wheat, is also much cultivated, and used as a substitute for other food, especially during journeys, and on military expeditions. Several culinary vegetables, such as carrots, turnips, the turnip-rooted cabbage, onions, gourds, and water-melons, are likewise planted in gardens. The species of domestic animals attended to are chiefly goats, sheep, oxen, cows, and horses. The sheep, generally, are an excellent race, of a white colour, and long tails, and produce a fine wool. The horned cattle are of a small size, and are much employed in drawing the two-wheeled carts used in the country, known by the name of Arbes. The care of horses, as might be expected to be the case among roaming and predatory knights, is in these parts a very particular object of attention. In conducting this business, which is prosecuted with a zeal and assiduity suited to its conceived importance, the Circassians aim not merely at beauty, but also at strength, ability to endure hunger and fatigue, and at superior swiftness; all qualities necessary to secure the success of the expeditions of one kind or another in which they are so frequently engaged. They pride themselves much on the supposed excellence of their horses; and almost every princely and noble family boasts of a particular breed, which is marked out and distinguished by the impression upon the animals when young, of the characteristic mark of the race. In this matter, so scrupulous is the adherence to custom, so conscientious the regard to the strictest rectitude, that any one who should attempt to burn a character expressing noble descent on a foal of common extraction, would, for such a forgery, forfeit his life. The Circassians rear, moreover, poultry of almost every species, such as chickens, geese, ducks, and especially Indian fowls of a peculiar size and beauty. They pay considerable attention to the cultivation of bees, on account of the intoxicating quality of the mead, which is their favourite beverage. These bees they keep in hives placed on stocks, and carry them along with them as they remove and change their habitations.

The manufactures or commerce of the Circassians seem to be but inconsiderable. The points of their arrows are the only articles of iron which are wrought up by themselves. Their women make a very strong thread of wild hemp, but are not acquainted with the art of weaving linen. Of the wool produced in the country, part is carried to market in a raw state. Of the finer portions of the remainder, the women prepare very good cloths, but which are narrow, and remain undyed. Of such cloth, there are manufactured entire upper dresses for sale. The black and coarse species of wool is used for felt cloaks, which are of a texture singularly light and durable. A few articles of leather, embroidered housings for horses, &c. are also fabricated in this country. The principal traffic of the Circassians consists in slaves, honey, wax, skins of cattle, deer, and tigers. Their agricultural produce is barely sufficient for their own use. Sheep and horses are considerable articles of their commerce, particularly the latter, which sell at very high prices. They have no money, and their whole commerce is carried on by exchange. Upon the whole, the balance of trade would be considerable against them, but for the number of slaves which they frequently obtain in their predatory excursions. These are chiefly Georgians; and the daughters of such slaves receiving the same education, and being fashioned to the desired shape in a similar manner as the young women natives of the country, are sold, according to their beauty, from L. 20 to L. 100. These latter, it is said, enter also themselves largely into the same description of traffic, being sold for the use of the seraglios in Turkey and Persia, where they often marry to great advantage, and thus make the fortune of their families. The merchants who come from Constantinople to purchase these girls, are generally Jews, who, as well as the mothers, are reported to be extremely careful in preserving the chastity of the young women, knowing the value that is set by the Turks, particularly, upon the marks of virginity.

The two opposite customs, or laws, those of hospitality and of revenge, are in general and sacred observance with the Circassian knights, as amongst most others of the nations of the Caucasus. The former, distinguished by the name of Kunak, is established on fixed principles; and every person submitting to its protection, is, of consequence, perfectly secure from all injuries. He who receives a stranger into his house, defends him, if the occasion requires it, not only with his own blood and life, but also with that of his relatives. He furnishes him at his departure with an equestrian escort, is answerable for him to his kinsmen; and his murder, or any insult offered to him, is punished as severely as in the case of a relation. A stranger who intrusts himself to the patronage of a woman, or is able to touch with his mouth the breast of a wife, were he an enemy, or even the murderer of a kinsman, is, in consequence of the interest thus secured to himself, spared and protected as if he were a member of the family. Bloody revenge is practised with an equally conscientious and scrupulous precision. The murder of a family-relation must be avenged by the next heir, or the nearest in blood, even though he was an infant at the time when the deed was committed. For the accomplishment of this purpose, every description of vindictive malice is allowed; but either in a more public, or a more clandestine manner, the life of the murderer must be taken away, if the injured party would not subject himself to the penalty of being considered and treated as an outcast from society. Nay, this desire of revenge is hereditary in the successors and the whole tribe; and such is the spirit of resentment, that even all the relations of a murderer are considered to be involved in his guilt. It is through this extreme infatuation to avenge the blood of relatives, that most of the feuds are generated, and the occasion, consequently, produced for so much bloodshed among all the nations of the Caucasus; for unless pardon be purchased, or obtained by intermarriage between the hostile families, the principle of revenge once excited, is thus in danger of being propagated to the latest generations. There is such a thing known in these regions as the price of blood. The name by which such a compensation is distinguished, is Thlil-uasa. Princes, however, and nobles, accept of no price in such a case: it is an established law among them, to demand blood for blood.

Education.

The education of the children of the Circassian princes, is of a nature calculated to suppress from the earliest infancy every feeling and affection peculiar to consanguinity. Sons and daughters are, immediately after birth,[*] entrusted to the care of a nobleman, frequently none of the most wealthy of that order;[†] and the parents, especially the father, have no desire to see a son, till he is grown up and capable of bearing arms, nor a daughter till after her marriage. The foster father of a young prince, is obliged to take upon him the whole charge of his education; he instructs him in all the schemes of robbery which are in greatest estimation amongst those equestrian knights, and provides him with arms as soon as he is strong enough to wield them. In return for all which attentions to initiate him in the predatory arts, he receives from his grateful pupil, at his entrance into life, the greatest share of the booty which he is able to obtain. In the education of the female children, it is a primary object, at whatever expence to them of privation and wretchedness, to give them the desired slenderness and elegance of form. They are trained to all ornamental work in the domestic economy of females, especially to embroidery, weaving of fringe, sewing of dresses, and the plaiting of straw-mats and baskets. A nobleman entrusted with the education of a young princess, is required, in fine, to procure for her a husband of an equal rank, or, in default of that concluding service, he is liable to be punished with the loss of his head.[‡]

In their amusements, the youth of both sexes among the Circassians freely converse with each other,* as, indeed, in more advanced life, the women of this country are generally neither confined nor reserved. In every thing, however, relative to marriage connections, the most particular attention is paid to the rank of the parties; and unsuitable matches are guarded against, by the infliction of the most rigid penalties. Farther, when the son or daughter of a family enters into the state of wedlock, they have no right to appear before their parents during the first year, or till the birth of a child. It is not till the same period has elapsed that a daughter obtains her full marriage portion; but on this occasion, a visit is paid to her by her father, who takes off the cap she wore when a virgin, with his own hands covers her with a veil, which from that time becomes her constant head-dress, and, finally, discharges what had hitherto remained unsettled of her dowry.†

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[*] A different account is, that girls are educated at home by their mothers; that it is only the male-children who are thus committed to the guardianship of strangers; and that, even with respect to them, the father, at their birth, does no more than choose a person who is, at a future period, to discharge towards them the duties of preceptor. When a year old, it is said, they are presented with playthings, and with arms; and if they appear to prefer the latter, this event is celebrated with great rejoicings. At the age of seven, or, according to others, of twelve, they leave their fathers' houses for those of the appointed preceptors, by whom they are taught to ride, to use arms, to steal, and to conceal their thefts. The epithet thief, it is remarked, is not here a ground of reproach, otherwise than it implies detection. Indeed, dexterity in the arts of pillage is the great object aimed at in education. From the simpler elements of petty pilfering, the youth are therefore trained by degrees, and led on to the practice of more considerable and dangerous robberies, and return not to the paternal mansion, till their cunning, address, and strength, are esteemed to be in some degree perfected. The preceptor is recompensed, for the trouble and expence at which he may have been in their education, by nine-tenths of the booty which they may have acquired during the period they were under his tuition.

[†] Sometimes the person pitched upon to receive that trust, is a prince of another family.

[‡] The custom of committing, in this manner, the education of children entirely to strangers, has been supposed to be peculiar to the Circassians. But every where amongst the mountaineers of Caucasus, who universally subsist, in a greater or a less degree, by the practice of robbery, similar objects, at least, are had in view in the education of youth. It is said, that the system of tuition alluded to, is persevered in amongst the Circassians, chiefly with the design of preventing the bad effects to be apprehended from the excess of parental indulgence. At the same time, it is to be observed, that as the education of a child renders the preceptor, in effect, a kind of adopted father, and as this nation is extremely vindictive, a person who has killed any relative of a family, sometimes endeavours to steal away a child belonging to it, for the purpose of educating him, that, by this means, a door may be opened for a reconciliation. It is farther stated, that a vassal contrives to steal, upon occasion, and to educate the son of his prince; a he has no

Matrimony.

Between husbands and wives, particularly during the earlier part of their marriage-connection, there is observed a system of affected politeness, equally remote from reason and nature. An uncommon degree of reserve, indeed, especially among persons in the higher classes, seems all along to be maintained by the parties joined together by so very intimate a bond of union.‡ The origin of the peculiar custom prevalent here, in this respect, as well as of the principle of committing the education of children to strangers instead of their own parents, cannot apparently be traced to any distant nation. But if they are supposed to have been, from an early period, prevalent in Mount Caucasus, a reference to them may be of use in accounting for the fabulous descriptions which have reached us of the Amazons and Gargarenses, nations whose local position assigned by the ancient geographers seems to correspond with sufficient accuracy to that of the countries now occupied by the Circassians.

Language.

The language spoken by this people has been said to be common to them with the other neighbouring Tartars. In the different parts, however, of the great chain of mountains which bears the appellation of Caucasus, there is reason to believe that there is considerable variety of language. Few of the present inhabitants of Kuban Tartary can converse with any of the Circassian tribes. Indeed Pallas thinks it probable, that the Circassian bears no affinity to any other language; and that, according to report, their princes and usdens speak a peculiar dialect, which is kept secret from the common people, and used chiefly in their predatory excursions. The latest accounts of that country state, that those of the inhabitants with whom there had been found any opportunity of holding conversation, spoke in a dialect so harsh and guttural, as was by no means pleasing to the ear. The higher orders here are said to be not unacquainted with the Russian tongue. It appears, from a vocabulary of the languages or dialects of the Caucasian nations, published by Mr G. Ellis, that many of the words in use in these parts are the same as those of the uncivilized inhabitants of America; whence, it has been conceived, an argument may be drawn in favour of the opinion advanced by Hornius and others, that America was originally peopled by colonies from Asia, particularly from Scythia or Tartary. As there are no written characters in use among this people, those who would write in their language are obliged to employ for this purpose the Arabian letters.

Music.

The favourite musical instruments of the Circassians is the camil, a kind of flute, made commonly of silver or some other metal. It is about two feet in length, having only three finger holes towards the lower extremity of the tube. The mode of blowing this instrument is remarkable. A small stick is placed in the upper end of the flute, which is open at either extremity, and, being drawn out to the length of an inch, is pressed by the performer against the roof of his mouth. It is difficult to conceive how tones may be produced in this manner, as the performer's mouth is kept open the whole time, and he accompanies the notes with his own voice. From the violent straining of every muscle in the countenance, it would appear that the playing on this instrument is a work of great difficulty and labour. The sounds produced resemble those of the bagpipe.

Dancing.

The dances of the Circassians do not resemble those of any other nation. Ten, fifteen, or twenty persons, all standing in a line, and holding by each other's arms, begin lolling from right to left. They lift their feet as high as possible, to the measure of the tune; and the uniformity of their motions is interrupted only by sudden squeaks and exclamations. It should seem that the situation of the performers in the middle of the row must be extremely uneasy, yet even these, squeezed as they are from one side to the other, testify their joy in the same manner as the rest. After some time there is a pause, when a single dancer, starting from the others, prances about in the most ludicrous manner, but exhibiting two steps which may be assimilated to the movements of a dance as practised among the European nations. The first consists in hopping on one foot, and touching the ground with the heel and toe alternately of the other: the second, in hopping on one foot, and thrusting the other before it, so as to imitate the bounding of a stag.

The religion of the Circassians is Paganism; for

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doubt that, by his success in this attempt, he will ensure his own advancement to nobility. The point that is universally agreed upon, is, that wherever and by whatever person the office is discharged, the child must at least be educated at a distance from his father.

* This is the case particularly at the little rejoicings which take place here at festivals. Before a ball, the men show their activity and address in a variety of military and other exercises; and the most alert on these occasions, have the privilege of choosing the most beautiful partners.

† It is customary in Circassia, that a bridegroom, previously to his entering into the married state, should make to the relations of the bride a present of armour, chiefly of a coat of mail. This is considered as a sort of purchase-price given for the bride.

‡ In point of fact, it may be truly said, that, in Circassia, a husband is of all the world the person whose intercourse, ever with his own wife, is the most restrained and fettered, by a singular enough custom, to a dull and uninteresting formality. Indeed, if a husband will permit a stranger to see his wife, it seems to be a fixed point, that he himself should not accompany him; and so far is this article of good manners carried, that when any one comes to see the wife, the husband goes out of the house. In the manner even of constructing the houses, it may be added, that there is a distinct adaptation of them to the same modes and habits of life; they consist of two huts, of which one is appropriated to the husband and to the reception of strangers, the other to the wife and family, and the court which separates these two parts of the dwelling is surrounded by a palisade. It is said, that this artificial manner of living, is not in Circassia productive of any licentiousness of manners. The Circassian women, on the contrary, with all their charms, and in spite of such temptations, as it were even sedulously thrown in their way, are yet noted for their chastity; whether this estimable part of their character is to be considered as the consequence of their natural disposition, of a regard to reputation, or of the wish to make a generous return for the confidence reposed in them by their husbands. In other respects, the women of this country participate in the general character of the nation. They take a pride in the courage of their husbands, and reproach them severely when they have sustained a defeat. Farther, it is they who polish and take care of the armour of the men.

§ See his *Memoir of a Map of the Countries comprehended between the Black Sea and the Caspian*, 1788.

Religion.

though some of them were formerly Christians, and others Mahometans, and the rite of circumcision is still in use here, they have neither priests, Alcoran, or mosque, like other Mahometans. Every one offers his own sacrifice at pleasure, on certain days, however, appropriated to that purpose, more, indeed, from custom than in consequence of any positive command. The most solemn sacrifice is that of a he-goat, which is offered upon occasion of the death of near friends. At such times, both men and women meet in the field, to be present at the celebration of the solemnity. Then, the animal being killed, it is flayed, and the skin, with the head and horns, is stretched upon a cross at the top of a long pole, placed commonly in a quickset hedge, to keep the cattle from it. Near to this spot the sacrifice is offered, by boiling and roasting the flesh, which is afterwards eaten. When the feast is over, the men rise, and, having paid their adoration to the skin, and muttered over certain prayers, they are left by the women, and conclude the ceremony with drinking a great quantity of *aqua vitæ*, which generally leads to a quarrel before their final separation. The state of degradation in this country, as to virtue and morals, is at least fully in proportion to the smallness of the attention paid in it to religion. The Circassians are accused of frequent perjuries, and violation of treaties. Oaths taken on the Bible, or the Koran particularly, it is said, they break without scruple. Yet there are certain forms of oaths, it is alleged, as well as certain places, supposed to be the remains, or spots in the neighbourhood of the remains, of Christian churches, which are more respected amongst them, and which ensure their fidelity. The courage of this people, great as it is, it may be remarked, is not proof against religious terrors; and, like all barbarous nations, they believe, that what is called accident, may be influenced in respect to the manner of its occurrence, or retarded or prevented through the use of particular ceremonies.

Tribes.

There are several distinct tribes of the Circassians. The designations of the principal of them are the following: The Kabardines, the Beslene, the Temirgoi, the Pshedukhs, the Hattukai, the Shani, the Shagaki, and the Mukhoshians. These tribes, occupying respectively their particular territories, and subject to the authority of their own rulers, agree in the main as to the leading outlines in their condition and character. Generally, they apply themselves more or less to agriculture, and to the rearing of cattle. Some of the tribes are wealthy and powerful. The resources of others are less considerable. In various degrees they are addicted to robberies, and frequently are involved in broils, either amongst themselves respectively, or with one another. The amount of the population of this whole country it is difficult accurately to ascertain. From some data, however, on the subject, there seems reason to believe, that the Kabardines alone can bring into the field a power of about 10,000 privates, and 1500 usdens. The Temergoes, with their allies of Beslene, Mukhoshians, and Pshedukh, are stated to possess, when united, a force of at least 5000 effective men. When to these numbers is added the population of the other tribes mentioned, it may be readily understood how much, but for the prevalence of divisions among themselves, the neighbouring powers would have occasion to dread their too near approaches. Neither is this danger grounded solely on the consideration of their numbers. They are a gallant and warlike people, and are bound by every tie to follow their prince into the field, and zealously and faithfully to yield an implicit obedience to his commands.

It is obvious how very formidable this people would become, were they ever to be united under the government of one chief. A nation of mountaineers, however, it is to be observed, who are forced, for the sake of pasture and water, to fix themselves upon the banks of the detached rivers, soon forget their origin, and are divided into separate and hostile tribes. This is so much the case with the Circassians of the Cuban, and their power is therefore so inconsiderable, that they are scarcely known even to the Russians, but by the general appellation of Cuban Tartars, in which they are confounded with their neighbours the Archaseans and the Nagair.

Kabardines.

The branch of this nation most interesting to the historical inquirer, is that usually called the Great and the Little Kabarda; and this, both in respect of its own importance, and of its varied intercourse of war or peace, particularly with the adjoining great empire of Russia. The Kabardines, it is to be observed, hold themselves to be of Arabian origin; and not improbably they are the remains of the armies formerly sent by the caliphs against Caucasus; others deduce them from the Mamelukes. General tradition, confirmed by still subsisting names, shews, that they formerly inhabited the Crimea. At what period they extended their possessions along the banks of the Kuban, and in the country of the Beshtan, cannot, at present, be easily discovered. It is probable that they were first subject to the rulers of Georgia, together with a considerable part of the Caucasus. After the separation of that kingdom in the sixteenth century, and particularly after the defection of the provinces of Mingrelia, Guriel, and Abasa, they became subject to the Khan of Crimea. In the same century they submitted to the protection of the Czar, Ivan Vassilizvitch, who, about the year 1560, married a princess of their country. In the 17th century they again acknowledged the sovereignty of the Crimea; and when, in the beginning of the 18th century, they attempted to shake off this yoke, the Khan penetrated into their territory, and drove them before him to the mountains extending towards the source of the Baksan, where they fortified themselves with stone mounds erected in the defiles, which, to this day, have retained the name of the Crimean walls. Having, by a piece of the most nefarious treachery, extricated themselves from the dangerous situation in which they were thus placed, they felt the necessity, in order to avoid the consequences, of soliciting anew the protection of Russia. While they recognise the superior authority of this power, the Kabardines have continued to live in a state of immediate submission to their native princes, the three families of which rank acknowledged amongst them, they pretend have all been derived from the same source. The nobles, or usdens, are divided into the ancient equestrian nobility, and such as hold that dignity from others, or the usden of usden. The third class is that of the vassals, or people, some of the circumstances in whose condition have already fallen under observation. A certain number of these is allotted to, and placed under the jurisdiction of each princely family. In these divisions respectively, the eldest individual is considered as chief of the family, judge, protector, and father of all the vassals attached to it. Out of this order, the princes have the privilege of raising whom they please to the rank of nobility, but they are equally empowered to deprive them, if they see fit, even of every thing that they possess.

History.

The Circassians are understood to have been descended from the Alanians, who settled on the northern side of the Caucasus soon after it had been occupied by the Yazamates. By them, or by races collaterally related to them, possession was gradually taken of the southern regions adjacent to the Kuban. During the empire of the

Chazares, the Byzantine emperors appear to have exercised a sort of paramount supremacy over this nation. The Circassians, however, remained truly independent in the upper regions of the mountains, and were still in possession of the whole eastern coast of the Sea of Azof as far as the Don. They rendered themselves masters of Kertsch in the Crimea, made frequent incursions into that peninsula, and into other European countries, formed the basis of the then rising Caucasian tribes, and founded a famous dynasty in Egypt. They continued equally unsubdued amidst the mighty changes every where effected about the close of the 14th century by the arms of the great Timur, and afterwards in face of the incursions of the Ottomans. While in the middle of the 16th century, as has been already stated, they, or a principal part of them, acknowledged for a short time the authority of the Czar Ivan II. of Russia, they yet about the same period formed, in conjunction with some of his native subjects, the state of the Don Cossacks, retaining possession of all the islands of the Lower Kuban, the whole of its southern banks, and the regions contiguous to the Euxine. Subsequently to that era, this people, or portions of them, have, in respect to dependence, been in the state of vicissitude, of which some of the steps have been already noted, holding at one time of the khan of the Crimea, at another of the Porte, at another of Russia. Ever since the conquest of the Upper Kabarda by Ivan II., the sovereigns of the latter empire have been accustomed to style themselves lords of the Kabardinian countries of the Circassians and mountain princes. The reality of power, which has been far from being ever since connected with this sounding title, has, in recent times, been in some degree attached to it. Between the years 1740 and 1750, the princes of the Great and Little Kabarda several times took the oaths of fealty to Russia. And the separation of the Asiatic territories, usually comprehended under the general appellation of Circassia, having in 1783 been recognised to be made by the river Cuban, all the districts and stems in those parts, situated in the islands of the Lower Cuban, along the whole southern shore of that river up to its source, and in the regions bordering on the Euxine as far as Auchasia, have, since that period, been held to be in a state of proper subjection to the Russian empire. The Circassians in both the Great and Little Kabarda, are reckoned among the vassals of that power.

This division of that people being the most considerable of all the tribes on the northern side of the Caucasus, the imitation of their manners has been so general among their neighbours, that, in this respect at least, all these tribes may be looked upon as the component parts of one great nation. Some of the traits principally characteristic of this people have already been mentioned. The following also are deserving of notice.

Government.

No prince among the Circassians can be a landholder. The only property of those of this rank consists in their arms, horses, slaves, and the tribute which they can extort from the neighbouring nations. The person of every prince is esteemed sacred. This, however, is the only distinction of birth unaccompanied by personal merit. The greatest honour which a prince can gain, is that of being the first of his nation to attack or to restrain an enemy. In time of peace, the princes are not distinguished from the nobility, or even from the peasantry, their manner of living being the same, and their houses, or other accommodations, being little superior to theirs. The rank of nobility is founded in part at least, and, in some instances, on an elective title; it being in the power of the prince to raise at his pleasure to that dignity, persons from the inferior classes of society. The nobles are the officers of the prince, and are entrusted with the execution of the laws. On important occasions, he calls a council of those of this rank, and the resolutions that are agreed on are communicated through them to the people. In the general assemblies of the people, it is equally their part to endeavour to gain the public assent to the measures proposed by the princes. The people, as well as the usdens or nobility, are, or may be, proprietors of lands. It is somewhat singular, that the princes who have themselves no property of this kind, yet claim, and sometimes attempt to exercise, the right of seizing the whole of that which belongs to their vassals. It seems equally an inconsistency, that, under these circumstances, a vassal when he thinks himself aggrieved, should have it in his power to transfer his allegiance from his native to any other prince. It is plainly the effect of this last arrangement, to render the former in a great measure nugatory, as, in consequence of it, it not only becomes necessary for a prince to endeavour to gain the affections of his vassals, if, through their exertions in the field, he would cherish the hope of acquiring for himself either greatness or wealth; but it is, in reality, through a persevering attention only to accommodate himself to their wishes, that he may reasonably expect to retain for any length of time over them, even the shadow or any appearance of authority.

Laws.

The Circassians do not appear to have any written laws; but they are governed by a kind of common law, or a collection of ancient usages. On great occasions the whole nation is assembled, when such measures as are deemed expedient being proposed by the eldest of the princes, they are first discussed amongst the usdens, afterwards by the deputies of the people. Their deputies are generally of the older men of the nation, who possess ordinarily with their constituents a greater influence than is attained to even by the prince himself. When a proposition thus introduced and carried forward has been finally acceded to, it is, for the sake of the greater security, commonly confirmed by a solemn oath taken by the whole people.

It is agreeable to the customs of the Circassians, that, at their meals, the whole families, some of the parts of which are at other times little together, should assemble severally to partake in common of their necessary food. Hence it is, that here, as among the Tartars, each village is usually reckoned at a certain number of kettles. The manner of living among this people is extremely simple. One part of their food consists of a little meat, either the flesh of the game in which the country greatly abounds, of beef or mutton, or what it is said is preferred to all others, of the flesh of a young horse. Together with this, they make use of some paste made of millet, or of thin cakes of barley meal baked upon the hearth, and which are eaten always new. Their usual drink is water, a kind of beer made from millet fermented, or mare's milk, from which latter there is here distilled a spirit, as amongst most of the Tartar nations. The Circassians do not uniformly allot stated hours for the refreshments of the table, or sleep, but upon occasions indulge in them irregularly, as inclination or convenience dictates. When the men make excursions into an enemy's country, they will even pass several days and nights successively without sleeping, and, at their return, they devote as much time to repose as they had thus been withheld from that gratification. In eating, it is the practice here to sit cross-legged on the floor, the skin of some animal serving as a carpet. The custom of smoking tobacco is universal among men, women, and children: whence, as in other Tartar countries, that is the most acceptable commodity which a traveller can carry with him into these parts.

It is the practice in Circassia for widows to tear their hair, and to disfigure themselves with scars, in testimony of their regret for the loss of their husbands. It was formerly usual for the men also, to give way to similar expressions of sorrow; but of late they have grown much more tranquil under the loss of their wives, or of other relations.

The chief city of Circassia is Terke. The prince who resides here is allowed a guard of 500 Russians, but none of his own subjects is suffered to dwell within the fortifications. Ever since the time that this country was subdued by Russia, not only governors and garrisons of that nation have been appointed to all places of strength in it, but it has been provided from the same quarter with its magistrates, and with priests for the exercise of the Christian religion. In subordination to the supreme authority of Russia, the Circassian Tartars acknowledge indeed their own princes, lords, and judges; but these all are obliged to take the oath of allegiance to his imperial majesty; they administer justice in his name, and, in matters of importance, not without the presence of the Russian governors. See Tooke's *View of the Russian Empire*; Pallas's *Journey through the Southern States of Russia in* 1793-4, &c; and Clarke's *Travels in Europe, Asia, and Africa*, vol. i. (K)

CIRCENSIAN GAMES, originally called *Consualia*, were dedicated to the god Consus, and were established by Romulus at the rape of the Sabines. After the Circus was built by Tarquin the Elder, they received the name of Circensian games. The celebration of these games began on the 15th September, and continued five days; and they consisted in feats of leaping, boxing, wrestling, racing both in chariots and on foot, and throwing the javelin and quoit. (*j*)

CIRCLE.

ASTRONOMICAL CIRCLES having now entirely superseded the use of the quadrant, and become the principal instruments of almost every observatory, we feel ourselves called upon to devote a considerable portion of our work to the explanation of the principles of their construction, and of the most eligible methods of using them to advantage.

The astronomical quadrant is so simple in its construction, and one instrument of this class differs so little from another, that the description of one will easily render intelligible the construction of all the rest. It is not so, however, with the astronomical circles. So very various have been the views and conceptions of the different artists who have been employed in these instruments, and perhaps even of the same artist at different times, that, except in circles of small dimensions, we believe that two have never yet been made alike. Hence we find no small difficulty in selecting such examples as may be reasonably expected to continue of universal and permanent utility.

Circle made by Ramsden for Piazzi.

The circle of Piazzi, at Palermo, constructed by Mr Ramsden, was the first large instrument of modern construction, and has become justly celebrated in the history of practical astronomy; but it owes its celebrity certainly more to the industry and sagacity of the observer into whose hands it has fortunately fallen, than to the accuracy or soundness of the principles on which it is constructed; for though it contains numberless examples of beautiful invention and contrivance, yet upon the whole it is an instrument that no judicious artist would ever wish to make again: We shall not therefore detain the reader with any particular description of it, but shall only observe, that it is an altitude and azimuth instrument. The diameter of the vertical circle is five feet. The plumb-line by which it is adjusted, referring to two fixed points in the limb of the circle, cannot be examined at the moment of observation: From this cause, and from the effect of expansion, to which, from its faulty construction, it is much exposed, a single observation cannot be relied on, nearer than to five seconds, though a mean of several will probably be much within that limit.

Wollaston's transit circle made by Carey.

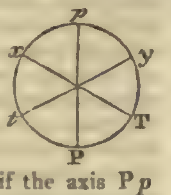
In the year 1793, Mr Wollaston published a description of a circle made for him by Mr Carey, and which he very properly terms a *Transit Circle*. This instrument had an accidental defect, (the axis having been made rather too slender,) but with this exception the instrument was a very good one. The beauty of the workmanship of Carey's instruments cannot be surpassed; and the whole of this instrument was better imagined, than the large one above noticed of Ramsden. It was not, however, intended to turn freely in azimuth, but, on the contrary, principally designed as a transit instrument, which intention appears to have been accomplished with the greatest precision. For this practical success of combining two instruments in one, astronomers are certainly much indebted to Mr Wollaston. Piazzi, in enumerating the advantages of a circle, mentions this combination: but certainly his circle would be a very imperfect transit instrument, or more properly speaking, it would be absolutely useless in this capacity. Carey has constructed several of these instruments, which perhaps would be all improved by a very slight alteration in the mode of applying the plumb-line. His method is nearly similar to Ramsden's above noticed, and subject to the same objection, as will be better understood when we come to treat of the more detailed construction of particular instruments. It is in this circumstance (among many others) that Troughton's instruments differ from Carey's and Ramsden's. The principle of these two methods is thus shortly described by Mr Pond, in the *Philosophical Transactions* for 1806.

Ramsden's method of applying the plumb-line.

In Mr Ramsden's method, two points are taken on the limb of the circle; and when these are brought into a given position, by means of a plumb-line passing over them, the microscope or index is made to coincide with the zero point of the divisions. By this method the error in collimation remains constant; and if the adjustment is by any accident deranged, it can easily be rectified, and there will be no absolute necessity for frequently reversing the instrument; so that this method seems well adapted for large instruments, particularly if placed on stone piers. But it is liable to this defect, that the adjustment cannot be examined at the moment of observation; and if any change should take place in the general disposition of the frame-work, the observation will be erroneous, without the means of detection. It was probably to avoid this inconvenience, that Mr Troughton in most of his instruments, particularly if they were intended to move freely in azimuth, has preferred the other method.

Troughton's method.

In this case, the plumb-line is attached to one of the pillars which support the microscopes in the way above described; and it has no reference to any fixed points or divisions on the limb of the circle, but only insures a similarity of position in the index for each position of the instrument; and provided that the plumb-line apparatus was free from all danger of derangement, this would be sufficient. This verification may perhaps be rendered more intelligible, by considering that a circular instrument, in whatever manner its vertical axis be placed, indicates, by a double observation, the angle which the object makes with the axis, round which the whole instrument has revolved in passing from one position to the other. For let P*p* be the axis, T*x* the telescope in one position; it is evident that in turning the instrument half round, *ty* will then be the position of the telescope, P*x* being equal to P*y*. The arc *xy* which the telescope passes through to regain its former position, is the quantity really given by the instrument; and if the axis P*p* be vertical, half this quantity is the true zenith distance of the object. Now the intention of Mr Troughton's verification is to insure a vertical position to the axis P*p*.



For instruments which rest on moveable pillars, and turn freely in azimuth, this method is much to be preferred; but it is not without a considerable defect, for if by any derangement in the plumb-line apparatus, the error in collimation be changed, it cannot be restored with certainty to its former position, so that sometimes a very valuable series of observations may be lost, for want of a corresponding one to compare with it.

Circle made by Troughton for Count Bruhl.

It was in 1792, after having made several smaller ones, that Troughton constructed a circle for Count Bruhl. The observations made with this instrument were very few, but exceeded in accuracy any that had been made before. The diameter of this circle was only two feet, but we are strongly inclined to believe that it exceeded in accuracy the five feet circle of Piazzi.

Ramsden's equatorial.

The equatorial instrument constructed by Ramsden for Sir George Shuckburg, properly belongs to the class of astronomical circles It will be more fully noticed under the article OBSERVATORY. Few observations have been, we believe, ever made with it. Indeed it is a waste of so very capital an instrument to place it in the equatorial position, because meridian observations will always *ceteris paribus* be better; and in practical astronomy, a *second best* method is absolutely of no use. This valuable and superb instrument has lately been presented to the Royal Observatory of Greenwich by the Hon. Mr Jenkinson, and is intended to be used both in the vertical and inclined position; and as an altitude and azimuth instrument, there can be no doubt but it will prove a most valuable acquisition.

Troughton's equatorial.

An equatorial instrument, by Troughton, of which the vertical circle was 3½ feet in diameter, was erected at Armagh; and Dr Hamilton's observations made with it were inserted with Mr Pond's, in the Transactions of 1806.

Several other circles were made by Troughton of different dimensions, varying considerably in the subordinate contrivances, but much resembling each other in their general principle. Mr Wollaston describes a very perfect instrument, by Troughton, of this kind, (not very unlike the one hereafter treated of,) in the Appendix to his *Fasciculus*; and gives some excellent directions to less experienced observers, which we shall avail ourselves of before we conclude this subject.

Circle made for Mr Pond by Troughton.

Mr Pond's catalogue of stars, which first demonstrated the defect of the Greenwich quadrant, was deduced from observations made with a circle constructed by Troughton, 30 inches in diameter, and is minutely described in the *Philosophical Transactions.* It is exactly similar to a smaller one now possessed by General Brisbane, and of which we have given a representation in Plate XLV.., and a description in the article ASTRONOMY, vol. ii. p. 727.

Circle made for Mr Groombridge by Troughton.

One of the most perfect instruments of the kind is that in the possession of Stephen Groombridge, Esq of Blackheath. It is a transit circle placed between two piers, made according to the idea suggested by Mr Wollaston. The four microscopes are placed in the horizontal diameter, two on each side, the instrument being on both sides divided. From observations made with this instrument, a very valuable paper on astronomical refractions has been already communicated to the public.

Circle made for the Dublin observatory by Ramsden.

The largest astronomical circle that has been yet constructed, is that belonging to the observatory of Dublin. The vertical circle is eight feet diameter. It was begun by Ramsden, and finished by his successor Mr Berge. It was erected about the year 1807. We have not seen any printed description of it, nor have many observations made with it yet been published; but we understand that the learned astronomer, Dr Brinkley, to whose care it is now entrusted, is perfectly satisfied with its performance; and it is with this instrument that he has been able to infer the apparent annual parallax of Lyræ, which he estimates to be between two or three seconds.

Circle made for General Brisbane by Troughton.

To the above, we may add a very beautiful two feet circle, in the possession likewise of General Brisbane, and which was actually the model of the six feet mural circle erected last summer at Greenwich. It differs in principle from all those above mentioned; and though it is not in our power at present to describe very minutely the mechanism of either of these instruments, of which no account has yet been published, we are nevertheless enabled to explain some of the more striking peculiarities in their construction.

The grand mural circle made for the observatory of Greenwich by Troughton.

The Greenwich mural circle was placed on its stone pier in the month of May 1812, and the observations for publication commenced the 11th of June. In the last volume of the Transactions for the present year (1813), the astronomer-royal has communicated his observations of the summer and winter solstice of 1812, and likewise a catalogue of some of the principal fixed stars, deduced from nearly 2000 observations. From what little is said of the construction of the instrument, it may be collected, that no use whatever is made either of level or plumb-line, but that the position of the polar point on the instrument is found by assiduous observation of the pole-star; and that the position of this point on the instrument is inferred, by comparing the observed places with the real places of a certain number of standard stars, previously determined by the instrument itself. By this method the astronomer-royal observes, that the position of his instrument may always be known to within a tenth of a second, a degree of precision which no level or plumb-line can ever be expected to obtain. We shall have occasion to insert this valuable catalogue, and to recommend the adoption of a method somewhat similar, when we shall have to explain the different uses of Borda's repeating circle, which we have hitherto omitted to notice, certainly not from its inferior importance, but because we have confined ourselves chiefly to the instruments of our own country. And as we propose to give a very minute account of the construction of this instrument, we shall only at present remark, that in France it seems to have superseded the use of every other astronomical instrument, for measuring either the zenith distances of heavenly bodies, or the angular distances of terrestrial ones.

This brief introduction embraces all the principal astronomical circles which we know of in fixed observatories. It is, however, our intention to give, under the article OBSERVATORY, a more detailed account of some of them, particularly Mr Groombridge's transit circle, and the mural circle now in use at Greenwich. For we mean here to confine our descriptions, &c. to the three distinct classes of portable circles, namely, the *Reflecting Circle*, the *Altitude and Azimuth Circle*, and the *Repeating Circle*; and beginning with the reflecting circle, we shall endeavour to trace its progress through the principal improvements which it has undergone, from its first invention down to the present time.

CHAP. I.

On the Reflecting Circle.

Reflecting circle.

THE instrument which bears the appellation of reflecting circle, is of the nature of Hadley's quadrant, and is built upon the same foundation; and, for the present, we shall consider our readers as acquainted with that well known instrument, a full account of the principles, properties, and use of which, shall be reserved, in order to be introduced under its appropriate title.

Although there are few purposes in practical astronomy and surveying, to which this kind of instrument may not be advantageously applied, yet it was originally constructed for, and has been chiefly used in making lunar observations, for finding the longitude at sea. The late Professor Mayer of Gottingen, the ingenious and laborious astronomer who first furnished tables for that purpose, seems to have judged well of what kind of instrument would ultimately be used, to effect the best practical solution of the lunar problem. Agreeable to this idea we find, that when he transmitted to England his solar and lunar tables, they were accompanied by drawings, and a description of the first reflecting circle, and were published by the British Board of Longitude in the year 1770.

As it is not our intention to extend this article to an unnecessary length, we shall, without farther introduction, proceed to a description of Mayer's instrument.

SECT. I. *Description of Mayer's Reflecting Circle.*

Mayer's reflecting circle.

PLATE CXLIV. Fig. 1.

Fig. 1. of Plate CXLIV. is a plan of this circle. Its chief part is a cross, surrounded by a circular limb all in one piece. Immediately above this is an index A, to which is affixed the telescope and horizon-glass. Still higher, another index B carries the central glass. Both A and B move freely round upon a pin fixed in the centre of the circle, quite independent of each other, and both of them apply close to the border of the circle, for the purpose of reading off its divisions. From the form of the exterior ends of the indices, one would imagine that the limb was intended to be divided by diagonal lines, but as the vernier was known at that time, it is probable, that no instruments were ever constructed in this respect like the figure. At the time the circle was proposed by Mayer, the art of dividing instruments was in a very rude state, and to render bad dividing of little or no consequence, was the aim of this particular construction.

It will be presently seen, that, with this circle, as many observations as we please may be successively made from point to point upon the limb, without reading off any more of them than the accumulated angle, having previously indeed noted the point at which we commenced. This is a very different thing from taking many observations with a sextant or quadrant, when the angles that compose a set being all read off nearly upon the same part of the arc, will most probably be all affected with nearly the same error. It is also very different from making many unconnected observations with a circle, where the beginning and end are read off in each; for, in this case, every angle will be charged with two errors; whereas, when taken in the manner which the nature of this instrument requires, no more than two errors are charged upon the amount of observations, however often these may have been repeated.

To shew more particularly how this is performed, it will be necessary to return to our Figure. There the different parts are represented, as when the index and horizon glasses are parallel to each other; in which position, an object will be seen in the telescope through the transparent part of the horizon-glass, in exact contact with its own doubly reflected image; but by moving the index B towards the telescope, the reflected image will pass along to the left, and being followed by the instrument, may be made to coincide with any object seen directly on that hand; and now the index B would mark the distance between the reflected and direct objects, but it is totally unnecessary, and would even counteract the advantages of the instrument, to pay any attention to this point upon the circle. Instead of this, let the index A be carried forwards until a new point of parallelism is found, by making an object coincide with its own reflected image as at first. This being done, take the angle over again, by moving the index B towards the telescope, and following the motion of the reflected image to the left. In this manner proceed, by alternate observations for parallelism of the glasses, and angular distance of the objects, until you have made a sufficient set. By this beautiful contrivance, a small instrument is, as far as dividing may be concerned, rendered at least equal to a large one without it; but as the telescope, by which the contacts are made, is necessarily of small power, large instruments in this respect seem to have the advantage; yet, as many observations are required to make a set, the error arising from imperfect contact must be considerably diminished on the well known principle of taking means.

Improvements by Bird.

Professor Mayer proposed, that his new instrument should be 16 inches diameter; and for the purpose of relieving the arm of the observer from the weight of so heavy an apparatus, recommended that it should be supported by a staff, which should rest upon the ground or deck. Bird, who probably made the first of these instruments, improved upon that idea. He made the staff communicate with a belt, which buckled round the loins of the observer. The staff was double, being composed of two sliding tubes. These moved one within the other, for the purpose of adjusting the height of the circle to the eye of the observer, and by the help of a *ball and socket* attached to the centre of the instrument, he was enabled to accommodate its plane to the position of the objects. Bird also applied darkening glasses to the reflecting circle, and gave it every useful appendage which Hadley's quadrant had borne before. In particular it should be mentioned, that the telescope was attached to the index A by two double levers, which acted exactly in the same manner that the single ones do in the common parallel ruler. On these levers the telescope rose and fell, respecting the line of separation between the silvered and unsilvered parts of the horizon-glass. A consequent backward and forward motion necessarily took place. This is a much better contrivance for regulating the brightness of the two images, than that which was adopted afterwards for the same purpose by Borda. It is a curious circumstance, that Bird divided his circles into 360° instead of 720°, as the nature of all reflecting instruments require; whence it became necessary to double the angle read off in a single observation, and in continued ones, to divide the accumulated angle by only half the number of repetitions.

It may be considered an unfortunate circumstance for the credit of the reflecting circle, that Bird was its original maker; for the correctness of his dividing, determined Admiral Campbell to neglect the repeating principle altogether, which he deemed a troublesome mode of observation, and to use a single portion of the limb. He then saw, that the arc of the octant ought to be extended to a sextant, so as to measure 120 or more degrees, and represented to the Board of Longitude, that a sextant, the radius of which should be double that of the circle, would be equally manageable at sea. He was ably seconded by Bird in these speculations; and such was the opinion of astronomers and others, concerning the judgment of these two individuals, that, in this country, the sextant was immediately adopted for the nicer nautical purposes, to the exclusion of the octant and circle which preceded it.

It has just been said, that the accuracy of Bird's dividing caused the reflecting circle to be laid aside in this country; and we may add with equal truth, that the rude state of that art in France, occasioned that instrument to be adopted there.

SECT. II. *Description of Borda's Reflecting Circle.*

Borda's reflecting circle.

About the year 1775, the justly celebrated Chevalier de Borda, turned his thoughts to the improvement of the reflecting circle of Mayer, and, after 12 years application to the subject, gave his labours to the public in an excellent pamphlet, which appeared at Paris in 1787. In this work, the chevalier minutely describes the former construction, gives a particular account of his own improvements, as well as ample instructions for using the instrument, and accompanies these, with complete directions for finding the longitude by the lunar method, together with new rules and tables for this and other nautical purposes.

PLATE CXLIV. Fig. 2.

Fig. 2 of Plate CXLIV. is a representation of Borda's circle, which, upon a comparison with the figure of Mayer's, may probably at first sight seem to exhibit a trifling difference for a work of 12 years; but when we come to comprehend the effects that proceed from these alterations, we must acknowledge, with satisfaction, that the time was not spent in vain.

The great objection to Mayer's circle was, that it required two operations in order to obtain one result; namely, one for the parallelism of the glasses, and another for the angular distance of the objects. Borda removed this inconvenience in the neatest manner possible; and in doing this, gave the instrument new and useful properties. On looking at the figures, it will be seen that the telescope is drawn back, so that no part of it extends beyond the index-glass; and, that the horizon-glass is carried forward nearly to the opposite limb: these alterations, simple as they are, accomplish his greatest improvement. We have now two ways of making observations; for reckoning from the point of parallelism as the glasses are represented in the figure, we can carry the reflected image either to the left, by moving the index A forwards, or to the right, by moving the index B forwards; for the incident rays may now fall on the index-glass through a long range, either above or below the horizon-glass. The point of parallelism is of no more use, for we are now enabled to observe, at each step of either index, the correct double angular distance. Borda calls half of this distance an observation to the right, the other half, one to the left, and both together, he calls a crossed observation: he calls it crossed, because the image of the reflected object crosses the point of parallelism. To use the instrument, it is best, in the first place, to set the index B at *zero,* and then by the motion of A to make the reflected image of the object on the left, pass beyond the point of parallelism, following it with the circle until it arrives at, and coincides with, the object on the right; all this is preparatory. Looking now to the right, bring the glasses parallel, by moving B forwards; but pass that point, following the reflected image until it comes to the object on the left; the double angular distance will now be marked by B, but this is not yet to be noted. Perform a similar operation by the index A, reflecting from left to right, and a second by B, reflecting from right to left: proceeding in this manner, by alternate motions of the indices, until you have completed a sufficient set. The whole number of degrees now read off at B, divided by double the number of times which that index was carried forwards, will give the angle sought; and where the observations are connected with time, as in taking lunar distances, that angle will correspond with the mean of the times at which the contacts were made. It should be remarked, that had the index A been read after the preparatory step, another result might have been obtained from it; but it would have been required, that the set had concluded with a motion of A, or else that the crossed observations had been respecting it, reckoned one less in number.

For the sake of simplicity, these directions have hitherto been carried on, as if the two objects could be either of them reflected one to the other; but this will seldom be practicable; and it therefore becomes necessary, that the brighter of the two should be reflected to the fainter, as the sun to the moon, the moon to a star, &c. To make this appear, let the indices be supposed to stand as they did on completing the preparatory step; and suppose the objects to be the sun to the right, and the moon to the left; make the first observation by reflecting the sun beyond the point of parallelism as described above, until it coincides with the moon; to proceed further, would be to reflect the moon to the sun, which can seldom be done. But an easy and obvious expedient prevents the necessity of this; for, by turning the instrument with the divided side downwards, we place it in a position which changes an observation to the right into one to the left; and, consequently, in this position, the sun may again be reflected to the moon; thus, by alternate motions of the indices B and A, in alternately reversed positions, we gain a set of repeated observations, always reflecting the image of the brighter object to the fainter. *

Upon the index A, and half-way between the centre and horizon-glass, is a socket for holding a dark glass, which being screwed there, modifies the rays of a bright object, after being reflected from the index-glass; but is out of the way of those rays, when they pass again reflected from the horizon-glass to the eye. Close behind the horizon glass, is a similar socket for the same purpose; a dark glass applied here, will soften the direct rays, in cases where both objects are too bright for the eye, and in the few cases where the fainter image may be reflected. But as dark glasses, in either position, would intercept the incident rays, in very small angles, we find another application of darkening glasses for the reflected rays, the position of which is immediately before the index-glass, which they completely cover; these are not half so dark as those first described, because the rays of light pass twice through them, once before reflection, and again afterwards; three or more glasses of different colours and shades are applied at each of the three positions, but only one at a time can be used at any of them.

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* Analogous to this, it should have been stated, in the method of observing with Mayer's circle, that when the brighter object is to the right, the face of the circle must be used upwards; but when it is on the left, the face must be used downwards.

Whatever we have yet said respecting Borda's principal improvement, it must have its value appreciated fully as much for economy of time as accuracy of result. But when we consider that circles like Mayer's, as well as octants and sextants, have the angles which are measured by them charged with the full amount of the errors in the darkening glasses, Borda's construction must rise greatly in our estimation, and set its competitors at a distance. His method of making crossed observations completely destroys these errors; for, affecting the contacts to the right and left, by equal quantities, in contrary directions, they will, in every pair, correctly balance each other.

Plate CXLIV. Fig. 2.

The telescope of Borda's circle is attached to the index A by two cocks; these have each a slider, by which its line of collimation may be set parallel to the plane of the circle, as well as raised or depressed for the purpose of darkening or brightening the reflected image, by placing less or more of its aperture opposite the silvered part of the horizon-glass. Both the indices A and B are furnished with apparatus for quick and slow motion. A handle is screwed to the back of the circle at the centre, and stands perpendicular to its plane. This instrument has usually been made of 10 inches diameter, and divided to every minute; the whole limb comprehending, like all reflecting instruments, 720°. This is owing to the well-known law in catoptrics, that the angle of reflection is, in all cases, equal to the angle of incidence, and not on account of double reflection, as some authors have erroneously stated.

Sect. III. *Description of Troughton's Reflecting Circle.*

Description of Troughton's reflecting circle.

Many of the circles of Borda had been made in London by several different artists, chiefly for foreign orders, and for the late Mr J. H. de Magellan, who made a few trifling alterations in its construction, and who put in an ineffectual claim to the invention of the method of making crossed observations. It was in 1794 that one of those artists, Troughton, imposed upon himself the task of bringing forward, in an improved form, an instrument which hitherto seemed to have drawn towards it the attention of foreigners alone. We have heard Mr Troughton say, that it was with the utmost hesitation he dispensed with the repeating principle in his new construction; but considering that a well divided instrument can derive little or no advantage from its employment, and seeing that its rejection would afford him the means of a simpler and firmer fabric, he determined to put into the hands of his customers an instrument which, though greatly superior in precision, was in use and management not much different from those they had been accustomed to handle.

Plate CXLIV. Fig. 3. Fig. 4. Plate CXLV.

Plate CXLIV. Fig 3. is a representation of this instrument, exhibiting the face or side on which the divisions are made; and Fig. 4. as well as the perspective view, (Plate CXLV.) shews the construction on the reverse side, or side of the glasses. The simple border, with bars radiating from the centre, answers sufficiently well in Borda's instrument, where the weight is sustained on the handle at the centre; but, in the case now before us, where there are two handles applied parallel to the plane of the circle, and one of them bent round from the side to which it is fixed, a different figure was required. After many forms had been tried, that which is here given was alone found to preserve its shape unvaried in all positions. The handles are attached to the frame by screws at two opposite parts, where the bars cross each other; but besides this, they are also stayed at the centre. The index has three branches, at equal distances from each other; one of them carries the usual apparatus for quick and slow motion, which being set fast, or put in gradual action, governs also the other two. To this index is fastened an axis, which, after passing through a socket about two inches long, carries at the other end the index-glass. A secondary frame, attached to the main one by five pillars, is situated nearly an inch below it; upon this secondary frame are firmly fixed the horizon-glass and the telescope; on the same frame are also placed two sets of coloured glasses, one between the index and horizon-glasses, and the other behind the latter of them; the first for darkening the reflected image of a bright body, the second for darkening one seen directly. The distance between the two frames affords a relief, whereby the coloured glasses may be turned down, round a joint, for placing them out of the way when they are not wanted. The telescope with different powers screws into a collar, whose squared stem having its four angles worked through its whole length into a screw, passes through a barrel, which connects the main and secondary frames: the bore of the barrel is square next the telescope, and receives the squared stem of the collar; but higher, it is cylindrical and large. In this part, a spiral spring is enclosed, which exerting its force against the enlarged higher end of the stem, draws it along with the telescope upwards, while, at the exterior end of the barrel below, a female finger screw, acting on the stem, draws it downwards, and both together affords, by one action, the means of adjusting the telescope respecting the line of separation between the silvered and unsilvered parts of the horizon-glass; by this contrivance, the two objects under observation may be made of equal brightness, without taking the eye off them. There is also in the collar into which the telescope screws, the usual adjustment for making the line of collimation parallel to the plane of the circle.

It has already been said, that Bird's construction of Mayer's circle is, in this respect, preferable to Borda's; the latter is indeed very inconvenient, because with it an observer has to read the divisions of the two sliders, by which the height of the telescope, from the plane of the circle, is regulated; for should he, while observing, attempt any alteration, by using the two screws to suit the objects as their brightness varies, and happens to turn one of them more than the other, he would derange the parallel position of the telescope, and thereby render his observations of no value. The circle of Borda is, in many respects, mechanically defective; that highly important part, the centering of the indices, is very much so, for they move round the circle upon bearings no longer than their own thickness; and, consequently, want that steadiness which is derived from an axis.

The author of the reflecting circle now under consideration, had many reasons for furnishing its only index with three verniers. In the first place, he was desirous that as the repeating principle had been abandoned, some contrivance should be substituted for the purpose of reducing the errors of even good dividing. Three readings which, upon the principle of taking means, in a crossed observation, (a term we need no longer employ), probably reduce the error of dividing to one sixth part of its simple value; while, at the same time, they perfectly correct the error arising from any eccentric motion of the index. This kind of error, a very important one, is never entirely corrected in Borda's circle, except in the case of beginning and leaving off at the same point; for, should the repetitions be continued to more than a complete round, the error which at that point must have vanished, would be again generated.

Moreover, the three readings, when the angle measured is the sextantal one (120°) in a backward and forward observation, (answering to right and left in the other constructions), will just occupy the 720° degrees of this circle.

It might have been sooner noticed, that the degrees of this circle are subdivided into three parts of 20′ each, and that each branch of the index subdivides to 20″, the verniers having 60 divisions, whose length is equal in extent to 59 of those upon the limb.

The dark glasses, in sets of three, are fixed to the instrument in such a manner, that any or all of them may be used at the same time, as circumstances may require. This gives the circle before us a decided superiority over all the others. Nor is it a matter of small importance, with respect to convenience, that a handle is found both above and below: By one or other of these, in every possible position of the instrument that observations can require, it may be held right or left, as is found most convenient to the observer. It must, however, be acknowledged, that the reflecting circle is, under the best circumstances, held two or three inches farther from the observer than the sextant is, and, of course, bears proportionally heavier upon his arm. Mr Troughton is of opinion, that this inconvenience is the principal if not the sole cause, that the circle has not yet come into general use; but we would hope, that an inconvenience so trifling, cannot deter a good officer from exercising the best means of obtaining the truth; especially, when we consider how much is entrusted to his care, and that the safety of the whole depends, in a great degree, upon ascertaining, in a long voyage, a few points of longitude and latitude, upon which, with confidence, he can rely.

We are given to understand, that our present astronomer royal is a warm friend to the circle; and that, in the preface to the next publication of Nautical Almanacks, he intends to recommend this instrument. From the regard we have for the improvement of nautical science, we sincerely wish that Mr Pond's endeavours to extend the use of the reflecting circle may be as successful as he can desire.

The following instructions for adjusting and observing with Troughton's reflecting circle, may be acceptable to many of our readers. They are copied from a printed paper, which is usually given with the instrument.

Directions for Observing with Troughton's Reflecting Circle.

Directions for using Troughton's reflecting circle.

"Prepare the instrument for observation by screwing the telescope into its place, adjusting the drawer to focus, and the wires parallel to the plane, exactly as you do with a sextant: also set the index forwards to the rough distance of the sun and moon, or moon and star; and, holding the circle by the short handle, direct the telescope to the fainter object, and make the contact in the usual way. Now read off the degree, minute, and second, by that branch of the index to which the tangent-screw is attached; also, the minute and second shewn by the other two branches; these give the distance taken on three different sextants; but as yet, it is only to be considered as half an observation: what remains to be done, is to complete the whole circle, by measuring that angle on the other three sextants. Therefore set the index backwards nearly to the same distance, and reverse the plane of the instrument, by holding it by the opposite handle, and make the contact as above, and read off as before what is shewn on the three several branches of the index. The mean of all six is the true apparent distance, corresponding to the mean of the two times at which the observations were made.

When the objects are seen very distinctly, so that no doubt whatever remains about the contact in both sights being perfect, the above may safely be relied on as a complete set; but if, from the haziness of the air, too much motion, or any other cause, the observations have been rendered doubtful, it will be advisable to make more: and if, at such times, so many readings should be deemed troublesome, six observations, and six readings, may be conducted in the manner following. Take three successive sights forwards, exactly as is done with a sextant; only take care to read them off on different branches of the index: also make three observations backwards, using the same caution; a mean of these will be the distance required. When the number of sights taken forwards and backwards are unequal, a mean between the means of those taken backwards, and those taken forwards, will be the true angle.

It need hardly be mentioned, that the shades, or dark-glasses, apply, like those of a sextant, for making the objects nearly of the same brightness; but it must be insisted on, that the telescope should, on every occasion, be raised or lowered, by its proper screw, for making them perfectly so.

The foregoing instructions for taking distances, apply equally for taking altitudes by the sea or artificial horizon, they being no more than distances taken in a vertical plane. Meridian altitudes cannot, however, be taken both backwards and forwards the same day, because there is not time: all therefore that can be done is, to observe the altitude one way, and use the index-error; but even here, you have a mean of that altitude, and this error, taken on three different sextants. Both at sea and land, where the observer is stationary, the meridian altitude should be observed forwards one day, and backwards the next, and so on alternately from day to day; the mean of latitudes, deduced severally from such observations, will be the true latitude; but in these, there should be no application of index-error, for that being constant, the result would in some measure be vitiated thereby.

When both the reflected and direct images require to be darkened, as is the case when the sun's diameter is measured, and when his altitude is taken with an artificial horizon, the attached dark-glasses ought not to be used: instead of them, those which apply to the eye-end of the telescope will answer much better; the former having their errors magnified by the power of the telescope, will, in proportion to this power, and those errors, be less distinct than the latter.

In taking distances, when the position does not vary from the vertical above thirty or forty degrees, the handles which are attached to the circle are generally most conveniently used; but in those which incline more to the horizontal, that handle which screws into a cock on one side, and into the crooked handle on the other, will be found more applicable.

When the crooked handle happens to be in the way of reading one of the branches of the index, it must be removed, for the time, by taking out the finger-screw, which fastens it to the body of the circle.

If it should happen that two of the readings agree with each other very well, and the third differs from them, the discordant one must not on any account be omitted, but a fair mean must always be taken.

It should be stated, that when the angle is about thirty degrees, neither a distance of the sun and moon, nor an altitude of the sun with the sea horizon, can be taken backwards; because the dark-glasses at that angle prevent the reflected rays of light from falling on the index-glass; whence it becomes necessary, when the angle to be taken is quite unknown, to observe forwards first, where the whole range is without interruption; whereas, in that backwards, you will lose sight of the reflected image about that angle. But in such distances where the sun is out of the question, and when his altitude is taken with an artificial horizon, (the shade being applied to the end of the telescope,) that angle may be measured nearly as well as any other; for the rays incident on the index-glass will pass through the transparent half of the horizon-glass, without much diminution of their brightness.

The advantages of this instrument, when compared with the sextant, are chiefly these: The observations for finding the index-error are rendered useless, all knowledge of that being put out of the question, by observing both forwards and backwards. By the same means the errors of the dark-glasses are also corrected; for, if they increase the angle one way, they must diminish it the other way by the same quantity. This also perfectly corrects the errors of the horizon-glass, and those of the index-glass very nearly. But what is still of more consequence, the error of the centre is perfectly corrected, by reading the three branches of the index; while this property, combined with that of observing both ways, probably reduces the errors of dividing to one-sixth part of their simple value. Moreover, angles may be measured as far as one hundred and fifty degrees, consequently the sun's double altitude may be observed when his distance from the zenith is not less than fifteen degrees; at which altitude, the head of the observer begins to intercept the rays of light incident on the artificial horizon; and, of course, if a greater angle could be measured, it would be of no use in this respect.

This instrument, in common with the sextant, requires three adjustments. First, the index-glass perpendicular to the plane of the circle. This being done by the maker, and not liable to alter, has no direct means applied to the purpose: it is known to be right, when, by looking into the index-glass, you see that part of the limb which is next you reflected in contact with the opposite side of the limb, as one continued arc of a circle: on the contrary, when the arc appears broken, where the reflected and direct parts of the limb meet, it is a proof that it wants to be rectified. The second is, to make the horizon glass perpendicular. This is performed by a capstan-screw, at the lower end of the frame of that glass; and is known to be right, when, by a sweep with the index, the reflected image of any object will pass exactly over, or cover the image of that object seen directly. The third adjustment is, for making the line of collimation parallel to the plane of the circle. This is performed by two small screws, which also fasten the collar into which the telescope screws, to the upright stem on which it is mounted: this is known to be right, when the sun and moon, having a distance of one hundred and thirty degrees, or more, their limbs are brought in contact, just at the outside of that wire which is next to the circle; and then, examining if it be the same, just at the outside of the other wire: its being so is the proof of adjustment."

Description of the stand for the reflecting circle.

PLATE CXLV.

Plate CXLV. was chiefly designed to represent the stand, whereon the British construction of the reflecting circle has been frequently mounted for making observations on shore, such as, by the aid of an artificial horizon, we obtain altitudes of the heavenly bodies for the latitude or time, as well as by the lunar observations, to find the longitude on land. This perspective view was also intended to exhibit such parts of the instrument as are not sufficiently shewn in the other Figures.

At the bottom of the Plate, we see the tripod of the stand is supported by three finger screws, the use of which is not for placing the instrument perpendicular, which is their usual office; they are here designed to bring the objects under observation, exactly into the centre of the field of view, after having been brought nearly thither by hand. They also give that small motion which is required to make the images pass each other, for ascertaining the points of objects which ought to be brought into contact. These screws thus produce, in the simplest and neatest manner, the full effect that could be gained, were all the motions of the stand governed by adjusting screws. A vertical pillar is inserted into the centre of the tripod, and unscrews there for the sake of snug-packing. At the top of the pillar, and within it, there is an axis whereon the instrument turns round horizontally: this motion respecting stiffness being regulated by a finger screw at top. A cross piece above the pillar, to which it is attached, bears at its ends, about four inches apart, two upright supporters, in which is centered an axis at right angles to the former. The motion round this axis may also be clamped or set free, by two finger screws at its opposite ends. By these two motions, the circle may be placed in any position that observations can require. Two counterpoising cylinders, whose connecting levers apply at the ends of the horizontal axis, keep the instrument at rest in all positions. There is a socket fixed at right angles to the middle of the horizontal axis, through which the shank of a screw passes; and there is a cock firmly fastened to the centre of the circle, which receives the *tapped* end of the screw, just clear of the index-glass, binding the circle and stand strongly together, yet allowing a free motion of the former in its own plane round the shank of the screw as an axis.

The three motions of the stand above described are all essential; for with fewer the varied compound motion of the hand cannot be imitated. Steadiness in a stand for a reflecting instrument would be a property of no great value; for its only use is to relieve the arm of the observer from the weight, and allow him the free use of both his hands; one of which is always wanted to act upon the index-screw, while the other is required at the screws of the tripod; and, at the very moment of contact, should perhaps always be employed at the eye-end of the telescope, touching also the face of the observer, and thereby preventing the wandering of the eye. Thus mounted, the reflecting circle becomes of itself a little observatory, and enables a skilful observer to turn it to good account in the sciences of astronomy, geography, and navigation.

The greatest error to which dividing by a good engine is liable, we think may be taken at about 20″; the six readings required in a double observation, on different parts of the circumference, will probably reduce that error to within 5″; where the reflecting glasses and telescopes are good, and power considerable (about 12), a mean of contacts will come out within this quantity. And where every other source of error is corrected by the principles of the instrument, we are of opinion that a series of lunar observations will give the longitude on land nearly, if not quite as accurately, as can be obtained from an occultation of a star by the moon, when observed with a powerful telescope.

When the Lunar Tables, &c. of Mayer, as improved by Mason, were used for the construction of the Nautical Almanack, the sextant, as it came from the hands of our best makers, was, in point of exactness, nearly on a level with its columns: but the Tables of Gauss, computed from the theorems of La Place, left both far behind. These now, however, form the basis of our Almanack, and an instrument of commensurate exactness is to be found in the British circle.

With the reflecting circle so constructed, the Almanack so improved, and with Captain Mendoza's excellent Tables, which far surpass every thing of the kind seen before, finding the longitude, either at sea or land, is no longer either a doubtful or a difficult operation.

We shall close our observations on the reflecting circle with some account of the laudable endeavours of the gentleman, whose name has just been mentioned, to improve it, and to render it a companion worthy of his other nautical labours.

Sect. IV. *Description of Mendoza's Reflecting Circle.*

Mendoza's reflecting circle.

In a paper published in the *Phil. Trans.* for 1800, Captain Mendoza has described, at considerable length, one construction, and briefly mentioned others, all of which, however, lead only to extend the repeating principle. We shall confine our account to that which, to ourselves, appears to be the best, and we refer to the paper itself for farther information. It is offered as an apology for not having given a figure of this circle, that it is easy to describe its peculiarities in words, but extremely difficult to make them appear in a drawing.

The general fabric of this circle is, respecting the frame, position of the glasses, and handles, exactly as in Troughton's construction, to which the repeating property has been restored in a very ingenious manner, and so as to produce double the effect that is done in Borda's, by collecting the sum of backward and forward motion of the index into one reading. For this purpose, there have been added two very light circles, one of which he calls a flying circle, and the other a flying nonius. They are both centred upon the upper end of the socket, which receives the axis of the proper index, and of the great mirror. The motions of these two circles are free and independent of each other: they are situated one above the other close to the limb of the fixed frame, having no connection whatever with it, except at the centre. It will be remembered, that, in the former construction, the index with three branches had backward and forward motion; it is precisely so in this, only this index has but one branch, namely that with the screws for quick and slow motion. This index carries no vernier, nor are there any divisions upon the limb of the fixed frame to which it applies. The graduation is made upon the flying circles, the lower of which is divided into degrees, and every 20′; the upper one carries opposite verniers, subdividing the lower down to 20″. There is a clamp attached to the index, which lays hold of the flying nonius, and in an observation forwards carries it along over the face of the flying circle; and there is a similar clamp, which, laying hold of the flying circle in an observation backwards, carries it back under the flying nonius. The flying circle is, in the former case, clamped to the limb of the fixed frame, and in the latter, the nonius is secured in the same manner.

Now, as in the observation forwards, the nonius advances upon the circle, and in the one backwards, the circle recedes upon the nonius, it is evident, that the sum of the two motions will be given at one reading off. Instead, however, of reading here, forward and backward observations are to be repeated, until a sufficient set has been procured, and then the whole space that the circle and nonius have been moved respecting each other may be read off, and on being divided by twice the number of forward and backward motions together, will give the required angle. There are two sextants of coarse divisions made upon the fixed limb, whose *zeros* are distant from each other by the breadth of the index of the index glass; contiguous to these divisions slide two pieces, which, being set right and left to the angle about to be measured, will stop that index in the requisite positions for finding the objects nearly together in the field of the telescope. This useful contrivance enables an observer to take a set of sights of any number without looking at the divisions, the first and last excepted.

Mr Troughton first applied this neat contrivance to the circle of Borda, which, without it, is extremely inconvenient to use. It ought to have been mentioned in the account of that instrument, that a previous rough observation must be made for computing at what points upon the limb the two indices must be set, in order that the objects may be found together in the field of view; and it requires the observer, at every successive sight, to set the indices alternately to the computed angle; but, with this apparatus, a set may be taken in the dark.

Notwithstanding the great ingenuity displayed in these contrivances, we think that the reflecting circle last described, can neither be very accurate nor very pleasant in its use: the management of five clamps, which are to be made fast and loose in regular succession ten distinct operations to every pair of observations, any of which being mistaken or neglected would spoil a whole set, requires a degree of attention not to be found in every observer. And the liability which there must be, even in the best work, to force the flying circles from their places in clamping, and thereby to cause errors, without any means of detecting them, is a most forbidding circumstance. And should the index of the central mirror have a motion eccentric to those of the flying circles, the latter at every step will feel the effect, and in consequence, the result will be charged with the full error belonging to a single observation.

Sect. V. *Professor Hassler's Method of restoring the Reflecting property to Troughton's Circle.*

Professor Hassler's method of restoring the reflecting property to Troughton's circles.

Since the above was written, we understand that there has been suggested to Troughton an unexceptionable method of restoring the repeating property to his reflecting circles, without in the least diminishing the advantages of the fixed frame. In this the circular border of the frame is not employed; it has one flying circle, (which was probably borrowed from the instrument last described,) and it is divided in the usual manner. Two indices are employed; one of them, below the circle, is screwed fast to the frame, the other is above, having, like the circle itself, free and independent motion round the centre; the latter carries at the lower end of the axis the index-glass. Both of the indices have screws for quick and slow motion, which act upon the flying circle; and they are both furnished with opposite verniers, those of the lower index being brought round from below, in order to count upon the divisions of the circle. When the index and horizon glasses are parallel, the two indices cross each other at right angles; therefore the upper one has a range of backward and forward motion through the full sextantal angle, without interfering with the lower one.

The effect produced by this arrangement is as follows. In an observation forwards, the circle being clamped by, the fixed index, the moveable index advances upon the circle, and being clamped to it, the contact of objects is made by its proper screw. And in an observation backwards, the circle being released from the fixed index, is carried backwards along with the moveable one, receding upon the former, to which it is again clamped, and then the contact of objects is made as before. These alternate operations must be continued until a set is obtained; and then the upper index will give the amount of forward, and the lower that of backward observations. With respect to repeating the angle, this instrument produces the same effect as Borda's circle; but we cannot here come at the double result, as we did in the arrangement of Mendoza. In this latter, however, the clamping is performed after the contacts are observed, which is its great defect; but the former has no such impediment, the clamps being fixed before the contacts are made; and therefore, in this respect, stands equal to a sextant, or any of the former constructions of the circle.

To such gentlemen as wish for a reflecting circle which repeats the angle, we hesitate not to recommend the one we have just endeavoured to describe; and we have to inform the public, that they are indebted for the idea to Professor Hassler, a native of Swisserland, and a distinguished citizen of the United States of America.

CHAP. II.

Description and Use of the Portable Altitude and Azimuth Circle.

SECT. I. *Description of the Altitude and Azimuth Circle.*

Portable altitude and azimuth circle.

IN our article ASTRONOMY, we gave to our readers the figure of an altitude and azimuth circle, with a short description; and we there stated, that the instrument itself had been recently made for the observatory of Colonel, now General, Brisbane. That instrument was constructed upon the model of the one used at Westbury, by our present astronomer-royal; and the observations which he there made with it, enabled him to give to the public that admirable catalogue of some of the fixed stars, which appeared in the *Philosophical Transactions* for 1806. But as that instrument was of too large dimensions for convenient carriage, as the azimuth axis was long and pointed downwards, greatly enlarging the bulk of package, and as it required a pedestal of peculiar structure; however desirable these properties may be in an observatory, for which it was solely formed, it was rendered thereby quite unportable, and altogether inapplicable to geodetic purposes.

Plate CXLVI.

We have now before us, (Plate CXLVI.) the figure of an instrument, which is free from the inconveniences above stated, the external appearance of which, we presume, will engage the attention of our readers in its favour. In confidence that this will be the case, we shall, without further encomium, proceed to describe its construction and adjustment. We may, however, first premise, that in astronomy it is equally well adapted to the various purposes of the transit, quadrant, and equal altitude instrument; and in the field, it is capable of performing the office of the most improved theodolite, and levelling instrument.

The figure bears the date of 1810, the year in which the circle it was drawn from was really made; but 1792 is the date of its first production by the artist, whose name it bears.

Beginning our description at the bottom, the part BB represents a strong tripod, the feet-screws of which, A, A, with milled heads downwards, support the whole, and enable it to stand upon a table, window-seat, or stone pillar, as circumstances may require; its own packing-box is also fitted up for a pedestal, and serves in cases where a better cannot be provided. Immediately above the tripod, and in close contact with it, is the azimuth circle CC; centered upon a vertical axis, which is strongly united with the tripod at its centre. This circle is connected with the tripod, not only by the axis round which it turns, but also at three places near its border, but in such a way as to admit of a motion of three or four degrees only, wholly governed by a slow-moving screw, the head of which is seen below to the right. Below, and on the left, appears the eye-end of a telescope R, which is furnished with the means of vertical and horizontal motion. It is fixed to the circle, (not the tripod,) and partakes of the same motion with it, when acted on by the slow-moving screw. Round the vertical axis already mentioned, on the conical socket D, revolves the azimuth index, near to the circle, but yet without touching it. This index is, like the circle, an entire plate, deep for the sake of strength, and hollow for the sake of lightness; the edge terminates in a half contrate border, as appears at E. The index may be clamped fast to the circle by a screw, the head of which is shewn at *a*, when another, represented at *b* furnishes a gradual slow motion. Two micrometer-microscopes FF, for subdividing and reading the divisions of the circle, are well secured to the index by three pillars each. Their positions are on directly opposite points of the index with which they revolve.

At right angles with the microscopes, are erected upon the index two stout pillars GG, the use of which is chiefly to sustain the weight of the upper part of the instrument, and to render steady the ends of the transit axis. These pillars are connected by a piece T, with the socket of the azimuth axis near its upper end, by which means the pillars and socket are made mutually to support each other.

The principal part of the weight of the upper works is made to bear upon the tops of the pillars, and is sustained by a friction-wheel at the centre of each, as at *g*. These wheels are urged upwards by a spiral spring, the force of which is nearly equivalent to the incumbent pressure. On receiving the weight, the wheels retire within the pillar, and allow the different parts to find their proper bearings.

For the purpose of supporting a horizontal axis 16 inches long, which is nearly twice the distance of the pillars, a strong piece, as at *e*, projects outwards horizontally from each, and to these are affixed the adjustable angles, in which the ends of the axis rest, as shewn at *d*. The horizontal axis H, thus supported, forms the central part of the altitude circle IIII. This circle is double, each part being well connected with the axis, and as firmly united to the other, by short pillars placed perpendicularly between them. The divisions of this circle, as the one below, are degrees subdivided to every five minutes, and like them are read by micrometer-microscopes, which again subdivide to every single second. The microscopes are attached to the extremities of two bent conical tubes NN, which are screwed fast to one of the great pillars: the microscopic part is denoted by SS, and the scales, which exhibit the subdivisions, are represented at *h*, *h*. The circle is acted on by a quick and slow moving apparatus K, which is made fast to the opposite pillar, as shewn at G. It is so formed as to oppose a stout resistance in the direction of the plane of the circle, but in the line of the axis it is extremely flexible. The telescope ZZ passes through the central part of the horizontal axis, to which it is fastened; it is also united to the double circle, between the parts of which it is situated. A lantern, not represented in the Figure, applies to one of the large pillars, opposite to the end of the axis, on the reverse side, from which light is directed through the axis, perforated for that purpose, and falling upon a plane covered with gold-leaf, is from thence reflected to the eye, for the purpose of illuminating the field of view of the telescope. A level, as shewn at X, hangs upon two pivots fixed to the crooked supports of the microscopes, and occupies a position between the pillar and divided side of the circle: one of its pivots is adjustable by the finger-screw *r*. The level has sliding ivory scales, which indicate to a second the position of the parts with which it is connected. A similar level, not represented in the Figure, applies occasionally to the pivots of the horizontal axis, upon which it is made to rest when in use, having been previously passed through between two of the radii of the double-framed circle. This has also sliding divided scales, and, like the other, indicates single seconds.

The instrument above described is of moderate dimensions, the diameter of the vertical circle being 18 inches, and that of the horizontal one 15 inches. They are both divided by lines (not dots) into spaces of five minutes, and the parts actually divided are, by their respective micrometers, subdivided and read, as was said above, to every second. The essential part of those micrometers consists of two wires, which cross each other like an X, and are moved along by a fine screw, in the direction of a tangent, to that part of the circle which may be opposed to them. When the cross is at the *zero* of its scale, it is the index of the divisions of the circle, and the quantity to be measured by the motion of the cross is that by which the next dividing line has passed beyond that *zero*, and is always additive. The general construction of this micrometer is not materially different from the parallel-line one, which was described in our article ASTRONOMY.

The length of the upper telescope is 30 inches, the aperture of its object-glass 2 inches, and its magnifying power about 60. It is indeed furnished with eye-pieces of both less and greater power than this, which may have their use in particular cases; but in general, this is reckoned the most useful power for such a telescope. The lower telescope is only about 18 inches in length, and its aperture and power proportionable. The whole height of the instrument is something more than three feet, and its weight is about 75 pounds.

In the eye-piece of the upper telescope are placed five vertical and five horizontal lines, the angular distance of which is about 6′ 24″ of a degree; this distance, when the sun's diameter is 32 minutes, allows an equal portion of time between all the ten contacts in observing his transit, or passage over the meridian. The five horizontal lines are for the purpose of observing equal altitudes, and when the diameter of that luminary is as above, will, without moving the circle, afford ten distinct sights, and these also will be equal to each other.

The lower telescope has in its focus only two cross wires. It is never elevated to the heavens; its only purpose being to *keep watch*, so as to shew if the whole instrument preserves its position unvaried respecting some distant object, while a set of observations is carried on.

In the eye-end of the upper telescope there are several adjustments. One of these is for placing the cross-lines in the focal point of the object-glass; and this is effected by drawing out or pushing in the whole of the eye-piece respecting the main tube. The whole eye-piece also admits of a limited motion round the axis of vision, whereby the cross-lines are adjusted respecting their vertical and horizontal position. The plate in which the cross-lines are inserted, is acted on horizontally by two opposite screws; they draw, and produce that adjustment, which places the intersection of the middle lines perpendicular to the horizontal axis. When this is verified by reversing the circle upon its angular supports, the line of collimation of the telescope will describe a great circle round the axis on which it revolves.

The cross-lines of the lower telescope are also acted on by two screws, like the upper one; but these are for no other purpose than for bisecting an object with the greatest accuracy, which cannot be done by the motions of the telescope itself, because they are not governed by adjusting screws.

To proceed in our account of the adjustments of this instrument, we find the feet-screws ready for placing the vertical axis truly perpendicular. This they will do by help of the level X, which having its bubble brought to the divided scales in any position, and then the instrument being turned half round in azimuth, an error will appear the double of that by which the axis is inclined; one half therefore must be corrected by the feet-screws, and the other by the screw *r* which acts upon the level. This will set the axis perpendicular in the direction of the level; and now, the instrument being turned through a quadrant, and the level brought by the feet-screw again to the sliders, this adjustment will be effected. The first part of the operation is best performed with the level in the direction of two of the feet-screws, because the second may then be made by the other screw without danger of deranging the first. It need scarcely be mentioned, that the operation should be repeated for greater exactness; nor that, when the adjustment is perfect, the bubble of the level will preserve its centrical position, while the instrument is turned quite round in azimuth. By this adjustment, the telescope is made to describe lines parallel to the horizon. The reading microscopes may now be adjusted to their places, so as to have their *zeros* exactly in the diameter of the azimuth circle.

The next great adjustment is to place the vertical circle at such a height, that its two microscopes shall be directed to two opposite points in its horizontal diameter. This is done by the screw *f*, which, acting upon the angular bearings of the horizontal axis, carries it up or down, as may be required. The farther pillar has the same kind of screw, which acts in like manner upon the support of the opposite end of the axis. It must here be mentioned, that through an inadvertence of the maker, the draftsman had access to the instrument, at a time when the angular bearings *d* were screwed almost out of their sockets *e*, on which account the socket and friction-wheel *g* appears to lift the circle too high; and the draftsman, knowing that the microscopes should occupy the line of the horizontal diameter of the circle, added that part in the tubular support which is seen between the circular rings, which part was not to be found in the instrument.

With the microscopes now in the diameter of the circle, and the vertical axis perpendicular, place the detached level upon the axis, in such a manner that it may touch nothing else; now if it does not settle with the ends of the bubble at the divided scales, move the scales to the bubble, if it is within their range; but if it is not, bring the bubble to the scales, when placed at equal distances from the middle, by means of the screw *f*, and its fellow on the opposite pillar. Then reversing the ends of the level, see if the bubble settles at the indices; if it does not, alter one half of the apparent error by *f* and its fellow, and the other half by the sliders of the level. The instrument will now give azimuths and right-ascensions, (that is, when placed correctly respecting the meridian,) but without farther adjustment, zenith-distances are only indirectly to be obtained from it.

To adjust it in this respect, we may proceed as follows: Point the telescope to any very distant object, which bisect by the middle horizontal wire, and read off by the microscopes the apparent zenith distance; now reverse the instrument in azimuth, and turning the telescope again upon the same object, bisect it as before, and again read off the angle which they shew. One of these will be an altitude, and the other a zenith distance. On one being reduced to the same name as the other, the mean of them will be the true zenith distance or altitude respectively; and while the telescope bisects the object, the microscopes must be adjusted by their proper screws, so as to shew that mean. This operation may be repeated for obtaining a greater degree of accuracy; but its final determination should be deduced from observations upon many heavenly bodies, and the minute error that may remain unadjusted had better be allowed for.

The above are the grand adjustments of the circle before us; but there are many others which, to describe minutely, would require separate drawings. We do not, however, see the necessity for this; for the general reader will, by what has already been said, come at all he can want—a general knowledge of its construction, properties, and use; while those persons, who possess such an instrument, will, besides the above, have their attention guided to the parts of action; and the ingenious artist, who may attempt the making such instruments, will, by our description and figure, be enabled to proceed; for his own resources ought to supply what may be but partially represented. A brief enumeration, however, of some of the minor adjustments are here subjoined.

The microscopes of both circles have an adjustment for placing them in the exact diameters of their respective circles, which adjustment also sets them at their proper distance from the centres. By another adjustment, the whole length of the microscopic tube is varied, in order to make the magnified image of a division exactly measure the scale of five revolutions of the micrometer screw. A consequent adjustment of backward or forward motion of the whole tube restores distinct vision, which was necessarily lost by the former operation. The five single minutes are indicated by as many notches, seen at the side of the field of view of the microscopes; they are indented by the micrometer screw itself, and are adjusted to their place by a screw at the end of the box, opposite to the micrometer head, acting upon the plate which contains them. By these means, a revolution of the screw becomes the exact measure of a minute; and it only requires the head of that screw to be divided into 60 equal parts, in order to give seconds. This circular scale of seconds has a motion round the head, whereby its *zero* may be brought to the pointer, without moving the cross lines within.

Both the levels are constructed without adjusting screws, the moveable divided indices answering the same purpose; for if the point of adjustment, as ascertained by reversion, be within the range of the bubble, the performance will be equally accurate, as it would have been, had that point been in the middle of the tube.

It may be remarked, that, after the principal adjustments have been carefully made, they should not be disturbed on slight occasions. If, therefore, the horizontal axis were occasionally found to be out of level, to the amount of a second or two, it would be wrong to adjust it by the screw *f* or its fellow, because that would affect the circle respecting its reading microscopes. Such a small deviation would be best corrected by touching one or more of the feet screws.

Of the instrument which we are now about to dismiss, it has been said, that its principal telescope magnifies 60 times, and that the angles are read to single seconds; and we may add, that the circles being divided by an accurate engine, the work of which is estimated to be within 5″ of the truth, and the levels, by which the verifications are made, being ground to a long scale, so as to be depended on to less than 2″, reasonable expectations may be formed, that when used under favourable circumstances, two observations, in reverse positions with it, will give the place of an object in the heavens, in declination within 5″, and in right ascension within 0.5″ of time. Nor can much of this degree of accuracy be abated, where, in surveying, land objects are observed; but much depends here upon what kind of objects present themselves for bisection.

Small as the errors of this instrument, as just stated, may appear, contrivances have been suggested and applied, which reduce them to almost nothing. To give the horizontal circle this advantage, the top of the pedestal should be made double, and the upper half moveable in azimuth, carrying the instrument round with it, but capable of being firmly secured in any given position. By this contrivance, an angle in azimuth may be measured on as many different parts of the circle as may be thought necessary. This, in truth, gives to this instrument a property, but little inferior to the far-famed method of repetition.

A contrivance, which furnishes the upper circle with a similar advantage, was suggested by the ingenuity of our present astronomer-royal, as stated in his paper upon the declination of some of the fixed stars, (*Philos. Trans.* for 1806.) This is effected, by giving the reading microscopes a motion of about 60° concentric with the circle: for the sun and moon, which are continually changing their meridian altitudes, no such contrivance is necessary, except indeed for the former, at the points of his greatest declination; but for the fixed stars, which, without it, would always have their places given by the same division, the revolving microscopes are of the greatest value. By changing the places of these as often as we think necessary, the errors of division may be reduced to a quantity too small to deserve notice. In all cases, the angle, through which the microscopes are shifted from their horizontal position, must be applied to the observations as an error of collimation.

We may observe, that this construction of the astronomical circle seems peculiarly adapted to the convenience of a scientific gentleman when travelling. Its strong and compact figure renders it safe and commodious in carriage. All its verifications may be made in a short space of time by land objects; and its being applicable to all the purposes of astronomy and geodæsy, renders it, in our estimation, superior to the repeating circle, which is, for similar purposes, its only rival.

SECT. II. *General Method of making Observations with Astronomical Circles.*

If the instrument turn freely in azimuth, and has likewise a divided azimuth circle, this circle should first be placed in a horizontal position, a verification not always absolutely necessary, (except azimuths are to be observed) but which will generally be found convenient. It is performed, by bringing any one of the levels of the instrument into a parallel line with two of the feet screws. The bulb of the level being made to rest in a central position by the action of either of these screws, the instrument is then to be moved half round in azimuth, and if the bulb of the level has changed its place, it is to be restored to its former position, half by the action of one of the feet screws, and the remaining part by the action of the screw, which changes the position of the points of suspension of the level itself. If, upon a second trial, the level remains unchanged, then the level itself is adjusted, and the instrument is to be now brought into a position perpendicular to the first position. If the level now is no longer in its central position, the *whole* deviation is to be corrected by the foot screw; a circumstance particularly to be attended to, for the level once adjusted is always adjusted, whereas the position of the azimuth circle may be correct in one position, but erroneous in all the rest.

The axis of the vertical circle should next be made horizontal. This is known to be accomplished, when the hanging level remains stationary during a whole revolution of the vertical circle round its horizontal axis; but, in many instruments, the level is not capable of revolving with the circle, in which case it must be applied and reversed end to end, till the bulb remains in the same position at each application.

In large circles intended to be used as transit instruments, the exact verification of the horizonal axis is of great importance. If the level be very sensible, it is usually furnished with a scale. In that case, it is better to read off the deviation each way, than to attempt to bring the level to a central position. This verification is performed in the following manner: Suppose the divisions of the scale to represent seconds of space, and the central division, both of the east and west end, to be marked zero, then apply the level, and take three or more readings as follows;

	East End.	West End.
	3″.2 E.	2″.1 E.
	2 .7 E.	1 .7 E.
	2 .8 E.	1 .9 E.
Mean	2 .9 E.	1 .7 E.

Mean of the two 2″.3 E.

Now reverse the level, and take three readings. Suppose

	8″.5 W.	5″.5 W.
	8 .2 W.	6 .0 W.
	7 .3 W.	6 .5 W.
Mean	8 .0 W.	6″ W.

Mean of the two 7″.0 west.

But in the first position it was 2″.3 east.

Hence the mean of two positions is 2″.3 west. This small quantity may be corrected by the adjusting screw, particularly if furnished with a micrometer head, and a similar trial repeated.

It is in this manner that the transit instrument is levelled at the Royal Observatory, and the result is registered once a week in the transit book, and published with the annual observations.

The next adjustment, if not previously attended to by the maker, is to cause the image of a star to be formed accurately on the micrometer wire, which should be placed exactly in the focus of the object glass. This requires a very careful examination. Both a star and the micrometer should be seen at the maximum of distinctness at the same time. A double star, such as Castor, γ Arietis, or γ Virginis, should be chosen for this purpose. If, when these stars are seen distinctly double, the eye-glass requires to be drawn either in or out to improve the distinctness of the micrometer wire, it is a proof that the object glass itself requires to be drawn out a similar quantity, that the image may be thrown at its proper distance. It should be remembered, that this adjustment is precisely the same for either long or short-sighted persons, the alteration required for either is to be effected by the eye-glass only. The position of the micrometer wire should next be examined, to ascertain if it be parallel to the horizon. For this purpose, let any terrestrial object be bisected, and the instrument turned slowly in azimuth, if the same object remain bisected when at each extremity of the field of view, it is a proof that the wire is horizontal. If the circle does not move in azimuth, the vertical wire may be rendered perpendicular by a similar process. In each case, the wires are supposed to be perpendicular. Should this not happen to be the case, the horizontal wire may be examined by a star in the equator, which should remain bisected during the whole of its passage, and any error in the vertical wire will be rendered of no importance, by always observing the transit of a star. On the centre, indeed, the observation must necessarily be so made, when zenith distances and right ascensions are determined with the same instrument. What we wish to point out, is the importance of paying the greatest attention to the *horizontal* wire. If the two wires are not exactly perpendicular to each other, one must be erroneously placed, and this had better happen to the vertical than to the horizontal wire.

The line of collimation should next be made to describe a great circle of the sphere. This, when the instrument admits of it, is done by reversing the vertical circle in its Y's, and observing if the same terrestrial object be accurately bisected in each position; or the instrument may be turned half round by the azimuth circle, which is an equivalent operation. In very large instruments between stone piers this cannot often be done. The observer in that case, must be provided with two accurate meridian marks, one to the north, the other to the south, and when these are once adjusted, there will be no necessity to have recourse to this troublesome operation. We shall again have to recur to these verifications under the article TRANSIT INSTRUMENT.

SECT. II. *On the Method of conducting a series of Astronomical Observations with an Astronomical Circle.*

Almost all the instruments above described, resemble each other in this common principle, that they determine the zenith distances of the heavenly bodies by a mean of two observations, one with the face of the instrument to the east, the other towards the west.

Ramsden's and Cary's instruments generally require some previous adjustments of the microscopes, that is, each microscope is supposed to mark zero, when two points or dots, marked on the limb of the instrument, are brought into a vertical position, by means of a plumb line passing over and bisecting each of them. As these dots are as permanent as the divisions themselves, the observer need not be anxious to change frequently the position of his instrument, because the error of collimation once found will remain permanently the same, as long as the micrometer wires remain undisturbed. A long series of stars, therefore, may be observed with the face of the instrument in one position; and at a very considerable interval, if it should so happen, a corresponding series may be obtained in the contrary position, and this permanency of the error of collimation, and the increasing degree of accuracy with which it becomes known, is an advantage peculiar to these instruments.

In Troughton's circles, no previous adjustment of the microscopes is necessary; but as the result supposes that every part of the instrument remains strictly the same, they cannot be too often reversed; and we would advise the observer to change their position every 24 hours, which is no objection to an instrument moving freely in azimuth.

But in whichever of these modes the instrument be constructed, it will always possess the beautiful property of pointing out to the observer, with considerable accuracy, the maximum of its own probable error, which will be shewn by the discordance of the error of collimation, as deduced from different stars, and it may be taken as a general rule, that half the extreme difference of a great number of observations, will be nearly the maximum of error to which any one determination is liable.

In instruments of Mr Troughton's construction, great care should be taken to examine the level, or bisect the plumb line point at the moment of observation; and all those little precautions which we had occasion to recommend in our general treatise on Practical ASTRONOMY, should carefully be attended to.

When the observer, however, is not desirous of deducing every thing from his own instrument alone, he had much better avail himself of the *Greenwich Catalogue*, just published (1813) for the determination of the position of his instrument, which method we shall again have occasion to recommend in describing different methods of using the repeating circle.

The above observations relate to astronomical circles generally, and are not confined to any particular instrument; but the altitude and azimuth circle of Troughton is so universal an instrument, and so proper to be placed in the hands of students who are only commencing the study of practical astronomy, that we are induced, to extend the subject by adding the directions for its use, which have been given by Mr Wollaston in his *Fasciculus*; and this has been done in so clear and perspicuous a manner, that we shall offer no apology for transcribing the author's own words.

" Let us imagine," says he, " an observer cast upon an unknown shore, with no other astronomical instrument: having indeed a chronometer; but we will suppose that to be gone down: and having likewise a Nautical Almanack, and the necessary tables for calculation. We will consider him as knowing neither the longitude nor the latitude of the place, nor the hour of the day, within 15 or 20 degrees either way. The tracing of things thus from the beginning, will best explain what may be done by an instrument of this sort; any part of which process may be omitted, according to the data he may have on which to work.

Let him first drive a small stake into the ground, or make any other mark in the pavement or floor, whereby to ascertain the spot over which he means to place his instrument. Let him also provide some screen or shade to keep off the sun's rays when he is not in actual observation: for the levels are so sensible, that any shining of the sun unequally upon the instrument, will immediately be detected by them; and he will never satisfy himself with the adjustments. Were the levels less sensible he might not perceive the difference; but that difference would really exist, whether he could discern it or not.

Let him next set his stand over the mark, and the instrument upon it, as described already; and let him adjust it in every particular as truly as he can.

Let him also wind up his chronometer, and set that to the supposed time of day.

In the morning, two, three, or more hours before noon, let him point the telescope toward the sun, and a little above it; and, clamping the vertical circle, let him follow the sun till its upper limb just touches the first horizontal wire. Then, noting down the exact second of time, as shewn by his chronometer, when that happened, let him follow the sun again till its upper limb just arrives at the second horizontal wire. After setting that down as before, let him prepare for the third or central wire; by now clamping the instrument in azimuth likewise, and holding its adjusting screw between his finger and thumb, let him bring the preceding limb of the sun just to touch the third or central perpendicular wire, at the same instant that the upper limb just touches the third or central horizontal one. Noting that instant, and setting it down, let him now read off the azimuth marked on the azimuth circle, and set it down under the other; and then prepare for making the preceding limb to touch the fourth perpendicular wire, at the same instant that the upper limb arrives at the fourth horizonal one; setting that time down again, and reading off the azimuth again, and setting it down, let him do the same by the fifth wire each way, and record them as before.

He will now find the lower limb of the sun, and its second or following limb, ready for observing in the same way at the first, second, and third wires: making each perpendicular wire a tangent to the sun's last limb, at the instant that its lower limb just leaves the correspondent horizontal wire; and setting down the time, and after reading off the azimuth, setting that down too under the other. After these, the instrument may be released in azimuth, and the lower limb alone be observed, as it quits the fourth and fifth horizontal wires respectively.

As soon as the sun has thus passed all his wires, he should read off at both the microscopes the zenith distance and altitude at which he had clamped the vertical circle; and, if he has a barometer and thermometer, he should set down their station at the same time: for, though he probably will have no occasion to regard the precise altitude at which he made these observations, yet, if any thing should deprive him of the correspondent ones, he may wish to have it in his power to deduce his time or his azimuth from these: and the reading off the microscopes after all is over is attended with very little trouble.

These things at first will appear hurrying; and till a person becomes a little accustomed to it they certainly will be so. But after a little practice, there will be found time enough to go through the whole with ease; for the vertical circle remains clamped the whole time; and all the six azimuths lie much within the limits of their adjusting screw.

The easiest method of keeping so many observations from confusion is, to have a slate, or a sheet of paper, ready ruled into five columns, to correspond with the five wires in the telescope as they occur in succession, in which to write down the observation belonging to each wire, whether that be time or azimuth. For if any cloud or accident should deprive him of any one or more of his observations, he will then at once see afterwards which of them is missing, when he comes to compare the two sets together.

Leaving the instrument clamped for altitude, and screened entirely from the sun's rays, he must wait till it is at the same distance from noon in the evening to resume his task. For that, he must hold himself ready against the time comes; and, previous to it, he will do well to re-examine the adjustment of his instrument, to be certain that no change has happened in the stand or the central cone, so as to throw its axis out of a perpendicular. Let him then observe the same method in this second set of observations as he did in those of the forenoon; considering those wires as first, at which the sun's limbs touch first; and setting down the times of their appulse to each respective horizontal wire, and bringing the preceding or subsequent limb to the corresponding perpendicular one, and reading off the azimuths just as he did before.

When all are passed, he may release all the clamps, and replacing his shade, leave the instrument till he has reduced his observations.

Of corresponding altitudes, if he has observed them all, he will have obtained ten pair; and of azimuths six pair; which he must now select from each other.

In respect of corresponding altitudes, the practice is so common, and the method of deducing the time from them is so well known, that nothing need be said on that head. Indeed, if a person wish for instruction in that, he may find it in the late Mr Wales's *Tract on the Method of finding the Longitude at Sea by Time-keepers*; which contains new tables of equations for equal altitudes, and precepts for the use of them: a valuable treatise, which may be had at a small expence, and ought to be in the hands of every one who pays attention to these subjects.

But the idea of observing corresponding azimuths being perhaps new, or at least not very common, and seemingly peculiar to this instrument, it may call for a little explanation how to reduce them: and a very little will suffice.

They must be opposed to each other in pairs, just in the same manner as corresponding altitudes; the first in the morning to the last in the evening, and so of the rest. Then, deducting the one from the other, and applying half the difference between the two to the smallest number in each pair, it will give a number of degrees, minutes, and seconds, in which, if all the observations were perfect, the whole six pair would coincide; and, if they do not, the fair mean deduced from among them will approach nearly to the truth, *i. e.* the error of 180° on the azimuth circle from the true meridian.

To that mean point, deduced from these observations, the instrument must now be turned; and fixed there till the proper correction can be applied to it. Upon the telescope being turned down to the horizon each way, it may be observed what distinct object there may be either to the north or south that coincides with one of the perpendicular wires; or if no such object should occur, a mark may be placed each way, or either way, to which to keep the instrument, till the correction can be investigated, which is requisite on account of the change of the sun's declination during the interval between the morning and evening observations; for any alteration in his declination will affect the azimuth deduced in this way, as it does the hour; and neither of those corrections can be ascertained till the latitude of the station be known.

Yet may the latitude be now deduced, with fully sufficient accuracy for that purpose, by observing the passage of any one known star over the meridian, and reading off its altitude and zenith distance. The pole star, or any star of the first or second magnitude, will be found visible in the day-time with the telescope of this instrument; and the latitude being, though roughly, deduced from it, the correction for time may be sought in the usual way. That required for azimuth may as easily be investigated by this very simple formula, which the late Mr Wales constructed for this purpose."

Take the daily variation of the sun's declination from the Nautical Almanac. Then say, As 24^h is to half the interval between the observations, so is the daily change in the declination to its change in that half interval. Turn the half interval into degrees, minutes, and seconds; and reduce the change in that half interval to seconds. Then to the log. of the change so found add log. cosecant of half intervals + log. secant of the latitude of the station, the sum will be the log. of the correction in azimuth in seconds to be applied to the middle point. This will fall to the west of the true south point when the sun is advancing towards the north pole, and *vice versa* east when he is receding from it.

"Having calculated the necessary correction, you may then apply it to the azimuth before deduced, from a mean of the observations; and shift the instrument just that quantity, as shewn on the azimuth circle. Then clamping it firmly there with both of the side clamps, you may trust to its remaining in that position as far as the instrument itself is concerned; for when once those clamps are set, the tangent-screw for adjustment has no power over it.

Thus it becomes, to all intents and purposes, so far as its situation and size permit, a transit circle; placed very nearly, if not quite truly, in the meridian, from one day's observation alone; and ready for making some observations in that first evening.

The chronometer having been let go down, may have altered its rate, which as yet will be uncertain; though if the watch be good, that rate will not be unsteady. Its error at noon was known from the corresponding altitudes; and any observations of the evening may afterwards be reduced to the real time, when the rate becomes known. The passage of stars over the meridian, even in this first evening, will therefore be valuable; and if the moon should be among the number, an observation of her passage, and a comparison of it with that of a star nearly of the same declination, will already give great insight into the longitude of the station. The error of the instrument in collimation of altitude must be known, before the exact latitude can be ascertained; but as that error is not apt to vary even by carriage, the latitude may be confided in, within 10″, from the observations of the same evening.

By repeating the same process, either in whole or in part, as he may judge necessary, the next day, he will verify his meridian, or bring it still more near to the truth. He will obtain the rate of his time-keeper; and begin to feel a degree of confidence. For when once he has a mark in the meridian to which to re-adjust his telescope, he may, if he finds occasion, release the instrument, and turn it in any direction for other observations, knowing that he can replace it at pleasure. Yet must it be said, that in all instruments, the less they are moved out of any position, and their adjustments disturbed, the better they will always perform what is expected from them.

Another method there is, which has not often been practised, though it was found very convenient to General

Roy in his trigonometrical measurements; the calculating of the exact time and distance of the pole star from the meridian, when it is at its greatest elongation east or west; and by adjusting the instrument to it at that time, reading off the azimuth on its circle. After this, correcting the distance of the star from the pole by the co-sine of the latitude of the station, you will have the true azimuth of the star; the difference of which, from the azimuth observed on your circle, will give you the deviation of it from the true meridian. This does not require the time to be known or attended to with very great precision; because the motion of the star in azimuth is very slow indeed. And since it comes both to the east and west of the meridian in the space of every twelve hours, two opportunities of this kind offer every day.

Another method, where you have the time sufficiently correct, is, to calculate the meridian passage of the pole star above or below the pole. This occurs nearly six hours after the other; when, pointing the telescope of the instrument to the star, and following it in its slow motion, covered or bisected by the meridian wire, till the exact instant it is to come on the meridian, then clamping the instrument there, it will be found very nearly in the meridian indeed. If all the adjustments of your instrument are right, you will probably find it err but a few tenths of a second of time in respect of stars observed afterwards within the tropics.

These are methods of finding a meridian which seem best to be recommended with such an instrument; which, describing true verticals and horizontals, and giving the angles of elevation in the one and azimuths in the other, has all the requisites for such a purpose; and is itself a transit instrument encompassed by a circle, or a small portable *transit circle*, ready for meridional observations as soon as its true position is ascertained.

For the verifying of this position, or bringing it strictly to the truth, two methods may next be recommended: the one by the meridian observation of any circumpolar star above and below the pole; the other by the observation of two well-known stars over the meridian which differ considerably from each other in elevation, and observing how far the times of their passage differ respectively from the exact time of each by strict calculation."

We shall have occasion to consider these methods more at length under TRANSIT INSTRUMENT.

CHAP. III.

On the Repeating Circle.

SECT. I. *Description of Troughton's Repeating Circle.*

Repeating circle.

THE principle to which the repeating circle owes its existence, was discovered by Professor Mayer of Gottingen. That learned and laborious astronomer, in the year 1758, communicated his invention to the Royal Society of that city, in a memoir upon an instrument which he calls a goniometer, the principles of which he had mentioned to other astronomers eight years before. The goniometer was intended for observing angular distances between terrestrial objects in land surveying; and, although far from being well contrived for the purpose, it was capable of performing this much better than any instrument known at that time.

Description of Mayer's goniometer.

It consisted of two bars of about a foot in length; the lower one was attached to a stand and socket like a common theodolite, and capable of being turned round, or set fast at pleasure. The upper bar was connected by centre work to the lower, upon which it turned all round, and carried along with it a telescope, with cross wires for observation. The instrument had no divided limb, instead of which, upon the end of each ruler, was made a fine dot, and the angle by which the bars opened was measured, by taking off the distance between the dots in a pair of compasses, the angular value of which was ascertained on a line of chords of a proper radius, diagonally divided to the exactness of 2′. As the two bars were required to be moved quite round upon each other, the two dots could not lie precisely in the same plane, and of course their exact coincidence could not be determined. This error, therefore, as well as that of the collimation of the telescope, required some kind of artifice to remove. This was neatly done, by throwing these errors back into an angle on the outside of the real point of commencement, as will appear in the following example of the use of the instrument.

Method of using Mayer's goniometer.

Bisect with the wire of the telescope the object to the left, having the lower bar pointed a little more to that hand, and made fast to the stand. Now carry forwards the telescope, by opening the angle between the bars, and bisect the object to the right. The opening between the bars must now be taken in the compasses, and its value ascertained by the scale, which suppose to be 45°. With this distance unaltered, carry the instrument backward round the socket of the stand, until it again bisect the object on the left, and again by opening the bars, make the telescope bisect the object on the right. The angular opening of the bars must now again be ascertained as before, which suppose to be 75°. It is obvious, that this last quantity is twice the distance of the objects and the exterior angle, and that the former was the angular distance and exterior angle; therefore their difference 30° is the approximate angle between the objects, and this angle taken from the first measured quantity leaves the exterior angle 15°. This last quantity enables us to ascertain the point of commencement besides, and we have proceeded two steps in the business of repetition. The observations must now be continued, by turning the instrument backwards round the socket to bisect the object to the left, and the telescope alone must be carried forward to bisect the object on the right, and so on alternately until a great number of observations have been made; but care must be taken, that however often the bars are carried round, the operations may finish, when they are in a position that their angle may be measured with the compasses. Suppose we leave off when the instrument has gone through nearly a revolution, and that the opening of the bars is found to measure 44° 50′, this quantity, as well as 15°, the value of the exterior angle, taken from 360°, leaves for the whole amount of 10 repetitions 300° 10′, and this divided by the number gives 30° 1′ for the true angle. Some knowledge of the approximate angle is useful, to prevent the division being made by a wrong number, in cases where the repetition has been long continued. The intermediate sights, provided they are well taken, do not at all affect the result, and no error of the instrument is charged upon the total angle but those of the commencing and ending points; and whatever the errors of these may be, by long continued observation they may be almost annihilated. With this instrument, therefore, and indeed the same may be said of all the repeaters, the patient perseverance of the observer becomes the measure of the accuracy of results obtained by them.

Thus much we have thought proper to say respecting the goniometer, which, although certainly not a circle, belongs to the class of repeaters, and was the original step which led to the construction of the celebrated instrument, which is the more immediate subject of our present enquiries.

When Hadley's octant became known to the world, Professor Mayer was among those who rightly appreciated its valuable properties, and by extending its arc to a complete circle, for the purpose of reducing the errors of division, he gave it the repeating property of his goniometer, which he had before perhaps only thought of. The Professor was fully aware, that the common theodolite, and other surveying instruments, were capable of being used as repeaters; and we can assign no other reason for his giving the preference to the undivided bars, diagonal scale and compasses, than that scales must at that time have been more accurately divided than circles.

It was about the year 1789, when Borda first caused a repeating circle to be constructed for astronomical and geodetic purposes; and one of our motives for being so particular in what is said before, was to shew exactly how much is due to him. The former repeaters, it has been seen, gave but one result for two operations; but by the use of an additional telescope, applied as hereafter to be described, he procured the means of obtaining double results, but this advantage is not purchased at a less expence than three distinct operations. The astronomers of the continent of Europe, and particularly in France, where the art of dividing, except of kingdoms, is almost unknown, have been lavish of their praises of this instrument; while in this country, where that art is practised with equal success upon minuter objects, a prejudice against it has too long continued. As a proof of this, we believe that the late Mr Ramsden never made either a reflecting or a repeating circle. The prejudice is now, however fast wearing off, and this circle begins to take that rank among our instruments to which its merit entitles it. This we think will appear on perusing the following description, and from the examples as communicated by different observers.

Repeating circle. PLATE CXLVII.

Plate CXLVII. is a perspective representation of the repeating circle as made in London, and exhibits, for ought we know, as perfect a construction of that instrument as has yet appeared. In our description of it we shall, as we proceed, occasionally remark upon the difference between it and those made abroad, of which this professes to be in many respects a copy.

At bottom, a strong tripod with feet screws rests upon a pedestal. Two of the screws bear upon the concave tops of two plain brass studs, which are affixed to the pedestal, but the other screw rests upon an apparatus, whereby an exceeding slow motion is communicated to the instrument. This is represented at *a*. A steel spindle 15 inches long, a full inch in diameter at one end, and somewhat more than half as much at the other, has its thicker end inserted into the middle of the tripod, to which it stands perpendicular. This spindle or axis is worked, especially near the ends, with the most scrupulous attention to truth. A strong hollow brass pillar is nicely centered upon the extreme ends of the spindle, round which it turns with a free and steady motion, and resting with its base upon the middle of the tripod, sustains the whole weight of the incumbent instrument.

The azimuth circle 12 inches in diameter, united by 6 radii and a circular centre-piece to the pillar, moves round with it near to the upper surface of the tripod, but yet without touching it. This circle is graduated by lines into parts of 10′ each, which are met, and subdivided to 10″, by a vernier, as at *b*, attached to each branch of the tripod. All this is executed with the greatest care, in order that an angle may be well ascertained by a single observation, in cases where extreme accuracy is not wanted; and as the business of repeating is a very laborious task, and productive of a vast waste of time, this substitute will be considered by most observers as a very convenient relief. It may here be noticed, that, as the position of the telescope is fully three inches from the vertical axis, all angles, except in astronomy, and where land objects are very remote, must be subjected to a consequent correction, in proportion to the distance of the objects from the station.

The advantage of three readings over two for the limb of a theodolite, the telescope of which will turn quite round, is great, and was perhaps first noticed by Mr Pond. In two reverse positions of the circle, made by turning the telescope half round in azimuth, and also half round its own axis, three verniers will give the position of an object upon six different and distant portions of the circle; but where two opposite verniers are used, no more than two places of the circle are employed, for on reversion the verniers only exchange positions. A screw apparatus, as at *c*, attached to one of the branches of the tripod, clamps the azimuth circle, or allows it a quick or slow motion at pleasure.

The repeating circle of Borda has an azimuth circle of about four inches diameter, the single vernier of which subdivides it to 3′ or 5′: the edge is indented, and acted on by a pinion, for the purpose of turning it round, in the same manner that similar means are employed in the common theodolite.

To the top of the pillar is horizontally fixed a strong brass bar *d*, upon which a similar bar is laid, and secured there by two finger screws, the head of one of which is represented at *e*: this is the part where the instrument may be taken asunder for packing, or for more conveniently moving it from place to place. At right angles to the bars, and fastened to the upper one, are erected two supporters, in the tops of which are centered the ends of a horizontal axis, round which the whole of the upper part of the instrument may be turned. A semicircle *f* is fastened at its centre, to one end of this axis, and having its position parallel and contiguous to the interior side of one of the supporters, is occasionally laid hold of by a clamp attached to the latter, and thus affords the means of securing the principal circle and telescopes in any position that observations can require.

The centre-work of the upper circle is made fast to the middle of the horizontal axis, which it crosses at right angles; at its remote end, upon the socket of the centre, is placed a cylindrical counterpoise, which balancing the circle and telescopes, keeps them, respecting motion round the cross axis, at rest in every position. The counterpoise, in order to give it a maximum effect, is fixed at the greatest distance from the cross axis, which will allow it to pass the bar on the top of the pillar, when the face of the circle is put horizontal, or in changing its position from one side of the pillar to the other.

The principal circle is 18 inches in diameter, composed of an octagonal centre piece, into which are inserted eight conical radii; these being strong and tubular, are united at their extremities by a circular limb; strengthened in its place by a rim or hoop, which being screwed fast to its back, forms what is termed an *edge-bar*: the division of the circle is by lines, the distance between which is 10′.

To the back of the octagonal centre piece is screwed the axis whereon the circle and telescopes are turned round in the plane of the circle: it is nearly eight inches long, but only about two thirds of its length is employed for that purpose, working in the socket of the counterpoise; the rest forms a bearing round which the socket of the back telescope revolves.

Plate CXLVII.

An index with four branches, the verniers of which subdivide the circle to 10″, has an axis of steel attached to its centre, which passes through the whole length of the axis of the circle, the latter being a socket wherein it turns round, in the same manner that the axis of the circle turns in the socket of the counterpoise. This index is furnished with the usual apparatus for quick and slow motion, which attaches to, and forms a part of, its chief branch, as at *g*. There is another index, the position of which is behind the circle, having but one branch, and which carries no vernier; it is furnished with the means of being clamped, and put in gradual motion like the other: in clamping it attaches to the *edge-bar* of the circle: it is united to a socket, which embraces the part of the axis of the circle not occupied by the socket of the counterpoise.

The instrument has two telescopes similar to each other in almost every respect. The one in front of the circle is fixed to the index at half right-angles between two of its four branches; the one behind has a position forming the same angle with the only branch of the other index. The connection between the telescopes and indices is formed near the centres, so that the former may take the unbiassed direction which is produced by the axis alone, without being at all influenced by the irregularities of the limb. In the circles of Borda, the telescopes are made to take the direction of the circle, and the accuracy of their motions depends upon the truth of its plane. These telescopes are about two feet in length; the aperture of the object-glasses nearly an inch and three quarters, and they are provided with powers of from 30 to 60, according to their different eye-pieces. The telescope behind the circle has, in its form, only two cross lines: the plate in which they are fixed is adjustable respecting the vertical and horizontal position of the lines, and is also acted on by two drawing screws for placing the line of collimation parallel to the plane of the circle: two others at right-angles draw also, and are intended for placing the collimation parallel to a level, which is to be described. In the front telescope there are three lines crossing other three; these are adjustable exactly like the former, only the adjustment last mentioned is not necessary. As the telescopes of the repeating circle are designed to view objects very differently situated respecting distance, the eye-tubes of both have a motion given them, by teeth and pinions, whereby they may be brought outwards, in order to procure distinct vision of near objects.

Between the two portions of the axis of the circle, namely, that which works in the socket of the counterpoise, and that upon which the socket of the back telescope turns, there is securely united to the axis a wheel of about two inches diameter, the edge of which is surrounded by a circle cut into three pieces, and again joined at two places in the same manner as the links of a watch chain, and at the third by a clamping screw, which is seen in the Figure at *h*. To the middle piece of the cut circle, and opposite to the screw, is fixed an ear extending about five inches from the centre, and upon the front of the horizontal axis, a similar one is fixed: these two ears are connected by an adjusting screw, which, when the jointed circle is made by its screw to embrace the axis, furnishes the means of gradual motion to the circle and telescopes; but when the axis is released from the action of the clamp, the general motion is free. The apparatus last described is very superior to the means which Borda employed for accomplishing the same object. In the French construction, a wheel of about five inches diameter, with an indented edge, is fixed, beyond the remote end of the counterpoising cylinder, to the axis of the circle, and is acted on by an *endless screw*, which, for the sake of quick and slow motion, is thrown off and and on at pleasure. This screw, owing to its great distance from the parts which require its use, (the circle and telescopes,) must twist the centre work, and of course leave the parts at liberty to move after its action ought to have ceased; an impediment which, if not a very dangerous, is at least a very troublesome one, and productive of much loss of time.

Plate CXLVII.

For astronomical purposes, the telescope behind is of no use, instead of which a level is employed; and in order that it should apply immediately to its work, it is fixed, not upon the stand, which is the usual application, but upon the back index of the circle, and has the advantage of its quick and slow moving screws. The position of the back telescope being of necessity eccentric, the level is placed parallel to it on the opposite side of the axis, and becomes a counterpoise to the telescope, for which purpose it is made rather heavier than is otherwise required. The tube of this level is ground inside to a radius, which gives the bubble a range of about an inch and a half to a minute. Two ivory divided scales are placed over the tube, which indicate single seconds, and by which the position of the index is ascertained to about double that quantity.

Another level, the use of which regards the plane of the vertical circle, has one end affixed to the cross axis, and the other to the counterpoising cylinder: if, when that plane is adjusted perpendicular, the level is brought to the middle, it will, in future, ascertain the true position without having recourse to the original adjustment.

The upper part of the back index is formed into a semicircle of about half the radius of the circle itself, and upon the fore part of it are roughly divided two quadrants of zenith distance, and a blank of about half an inch separates their *zeros* from each other. Two small sliders, one of which is seen at *i*, are made to fit the arc of the semicircle, and their fiducial edges may be set so as to point to any division. To the object end of the fore telescope is occasionally attached an index *j*, which reaches down to the divisions of the semicircles, and at that end covers the space between the *zeros*. By this contrivance, when the sliders are set to the approximate zenith distance of a heavenly body about to be observed by repetition, the sliders and indices will touch each other at their relative positions, so as to stop the telescope at the proper point upon the limb for finding the object, near the centre of the field of view.

The azimuth motion has also its stops; a small cylinder of steel, pointed at one end, is lodged in a piece of brass, and urged forwards by the force of a spiral spring against the edge of the azimuth circle when used, but at other times it is put out of action. When the leading vernier of the circle shews 360° or 180°, the pointed end enters a shallow hole, which, for that purpose, is made in the edge of the circle, but so as only just to be felt on turning it round; for the point will retire of itself when a slight additional pressure is applied, and then it allows the instrument to turn freely round. With these contrivances, a bright object may, by repetition, be observed in the day time, or a faint one by night, the former without fear of losing it, and the latter without danger of mistaking another for it; and that without having recourse to the divisions at all during the intermediate observations.

An index carrying a microscope at each end, one of which is shewn at k, is applied to the centre of the fore index, by the help of which the four verniers are read; that is, two of them by each, for one will not read all the four, because the arm cannot pass the telescope. A similar arm is centred upon the base of the pillar, which, moving freely all round, its single microscope serves to read off all the three verniers of the azimuth circle.

Adjustments of the repeating circle.

Having now gone through the description of the repeating circle, it only remains that there should be given an enumeration of its few and simple adjustments. 1st, The azimuth axis is adjusted vertical, or the circle horizontal, by means of the feet screws and levels in the way practised in the corresponding adjustment of other instruments. 2d, The plane of the upper circle is adjusted vertical for astronomical purposes, by turning it round the cross axis; and the required position is ascertained by applying a plumb-line to the face of the circle. This adjustment is, however, obtained much more correctly, by observing any elevated object at rest, pointing the telescope upon it directly, and then observing its image as reflected from the surface of a fluid: the middle vertical wire bisecting, in both cases, is the proof of adjustment, and furnishes an unexceptionable criterion. 3d, The line of collimation of the telescope parallel to the plane of the circle. As both the telescopes have their positions eccentric, respecting the vertical axis, chuse, for this purpose, a very distant object, and as nearly as can be estimated in the horizon; bisect that object by the middle vertical wire, and then read off what the verniers of the azimuth circle give; now turn the face of the circle to the contrary hand, bisect the object in this position, and read the azimuth circle a second time; now carry the instrument in azimuth through half the angular difference, (abating 180°), as shewn at the two positions, and then the plane of the circle will pass exactly through the object; move now the wires of both telescopes by their proper screws, until they bisect the object. The fourth adjustment is of use only, when taking levels is the end of observation; it is to set the line of collimation of the back telescope parallel to the level; a very distant object is also required for this purpose, because the back telescope is lower in position than the front one. With every thing adjusted as before, bisect any object nearly in the horizon by the middle horizontal wire of the fore telescope, and read the divisions of the circle; reverse the instrument, both in altitude and azimuth, and bisect the object, and read the circle as before. The half difference of the readings will be the altitude or depression of the object; set the indices, therefore, to this half difference, and turning the instrument round in azimuth, look for a new object that is bisected by the wire; this object will be in the horizon, and the end will be accomplished by turning the back index until the level comes to the middle, and adjusting the horizontal wire by the proper screw, so that it may bisect that object.

The perspective view of the repeating circle shews all that is provided by the maker, and in the observatory is all that can be required; but in the field, as no one would think of placing it upon the ground, a stand is wanting; but this may be so simple in its construction, as to be made by any one accustomed to work in wood. It should consist of three spreading well braced legs, inserted at top into the under side of a round table, and united below by three crosses, reaching from leg to leg. The diameter of the table should be at least two inches greater than is required by the feet-screws of the tripod. It may be about three feet high, more or less, according to the stature of the observer; and if a circular groove in the surface of the table receives the feet-screws, the three studs may be dispensed with, and the whole instrument turned round in order to lay it in the plane of every pair of objects, the angular distance of which is to be taken at the same station; and that without losing the angular point, as indicated by a plummet suspended below the centre of the instrument.

There will seldom be found ground sufficiently firm to support the weight of the observer, without deranging the position of an instrument as he walks round it; and on this account, in the most accurate operations, it is usual to level the ground, and to secure steadiness by driving three piles of wood to a sufficient depth for the legs of the stand to rest on.

As perhaps the feet-screws of every instrument are the most unsteady parts, for the purpose of lessening this evil, these are made as short as possible. An observer, therefore, should provide himself with a number of wedges for propping the tripod, in adjusting the circle into the proper plane, agreeable to a rule hereafter to be given.

SECT. II. *On the method of observing Terrestrial Angles with the Repeating Circle.*

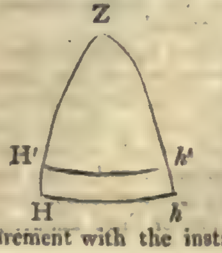
Method of observing terrestrial angles with the repeating circle.

The repeating circle, as above described, may be considered either as a geodetical or as an astronomical instrument; and it owes much of its celebrity to its having been employed in this double capacity by the French astronomers, in the great trigonometrical operations lately carried on in that kingdom.

Of the manner in which the repeating circle was used on this occasion, a most ample account has been given by the National Institute, in two quarto volumes, entitled *L'arc du Meridien.* Much useful information may likewise be found in Puissant's *Geodosie*, and in a single quarto volume, published separately by Delambre, entitled, *Methodes analytiques pour la Determination d'un arc du Meridien.*

In all these treatises, a great portion is allotted to calculations which become necessary, both from the mechanical construction of the repeating circle, and from the circumstances under which it must frequently be unavoidably used. Many of these considerations, being common to all instruments, will be given under SURVEYING. And of those which are peculiar to this instrument, our limits oblige us to omit a great many, and to confine ourselves to those which seem to us most likely to be of general utility.

The repeating circle will not measure the horizontal angle between two objects of different elevations, but it will measure the direct angular distance between two objects, and the zenith distance of each of them, from which data, the horizontal angle may be inferred by spherical trigonometry; and as, in each of these measurements, the repeating property of the instrument may advantageously be employed; the horizontal angle may no doubt be obtained to a very great degree of precision.



Let Hh be an arc of the horizon, H′, h' two terrestrial objects. Z the zenith, and ZH, Zh great circles of the sphere passing from the zenith to the horizon through the points H′, h'. Then in the triangle ZH′h', the three sides ZH′, Zh', H′h', being determined by actual measurement with the instrument; the angle Z, equal to the arc H *h*, may be computed by spherical trigonometry. The problem is very nearly, indeed, similar to the well-known case in nautical astronomy, in which it is required to determine the true distance of a star from the moon, having given its apparent distance, and the altitude of each by observation; and for each process, Tables have been devised to facilitate the calculation, which, without such aid, would be very tedious and laborious. The zenith distance of a terrestrial object being determined with this instrument, precisely in the same manner as the zenith distance of a star or other celestial body, nothing here need be said on that part of the process. We shall, however, subjoin an example actually taken by an instrument of Mr Troughton's construction, to shew with what extreme accuracy a result may be obtained by an experienced observer.

Zenith distances of a fixed mark, taken Sept. 4, 1812, with a repeating circle of Mr Troughton's construction.

			Angle given by each successive pair of observations.
Zenith distance given by	2 observations	92° 45′ 3″.2	92° 45′ 3″.2
			— — 6″.3
	4	— — 4″.8	
			— — 9″.4
	6	— — 6″.3	
			— — 8″.3
	8	— — 6″.8	
			— — 10.″4
	10	— — 7″.5	
			— — 4″.0
	12	— — 6″.9	
			— — 8″.7
	14	— — 7″.2	
			— — 5″.2
	16	— — 6″.9	
			— — 8″.7
	18	— — 7″.1	
			— — 5″.9
	20	— — 7″.0	
			— — 8″.7
	22	— — 7″.2	
			— — 3″.1
	24	— — 6″.8	
Mean of the twelve angles given by each successive pair of observations			92° 45′ 6″.8

In making the above observations the light was favourable, being steady and uniform; the sun was always hid.

The mark exceeded the wire some seconds on each side, and was not so round as could have been wished. A mark smaller and perfectly round might probably have been bisected more exactly.

In the 24th observation the day light began to fade, and it was apprehended that this observation was rather less exact than the preceding ones.

There is every reason to suppose, that in the above experiment the zenith distance of the signal was obtained within a small fraction of a second.

To observe the angle between two signals, the plane of the instrument must first be brought into the plane of the two objects. To accomplish this, first set the tripod of the instrument, with one of its feet as near as you can guess, in a line with that object, which of the two you judge to be nearest to the horizon; and, with the plane of the circle vertical, and the lower telescope horizontal, (both to the exactness of two or three minutes,) bring the telescope to the object, partly by turning in azimuth, and partly by screwing the foot screw; next turn the circle round upon the cross axis of the stand, until it seems by the eye to occupy the proper position, then a second time bring the telescope to the object, by the foot screw and turning in azimuth; lastly, complete the operation by bringing the upper telescope to the other object, by its own proper motion, in conjunction with that of turning round the cross axis. The principle of the above rule is this; the cross axis of the stand and the lower telescope being made parallel, and pointed to the object, the circle may be turned round that axis without changing the angular position of the telescope. When this verification is rightly performed, the intersection of the wires of the micrometer of the moveable telescope should pass over each object in its revolution round its centre. To effect this readily requires some little dexterity and practice.

The following example was likewise taken by an instrument made by Mr Troughton.

No. of Obs.	Angle by Inst.	Angle deduced.
2	127° 7′ 45″	63° 33′ 52.5″
4	254 15 24	63 33 51.0
6	21 23 00	63 33 50.0
8	148 30 30	63 33 48.7
10	275 38 10	63 33 49.3
12	42 45 50	63 33 49.1
14	169 53 20	63 33 48.6
16	297 00 50	63 33 48.5
20	191 16 17	63 33 49.0

The angle thus measured requires to be corrected for the eccentricity of the lower telescope; and this correction depends on the distance of the objects from the observer, and upon the distance of the axis of vision of the lower telescope from the centre of the instrument.

In circles constructed by Mr Troughton, the eccentricity of the lower telescope is one inch and four tenths; and the following Table is calculated upon this supposition from Delambre's formula given in *L'Arc du Meridien*.

Fathoms.	
1000	2.″00
2000	1.00
3000	0.67
4000	0.50
5000	0.40
6000	0.33
7000	0.30
8000	0.25
9000	0 22
10,000	0.20
11,000	0.18
12,000	0.16
13,000	0.14
14,000	0.13
15,000	0.13
16,000	0.12
17,000	0.12
18,000	0.11
19,000	0.10
20.000	0.10
21,000	0.10
22,000	0.09
23,000	0.09
24,000	0.08
25,000	0.08

Use of the above Table.

With the distance of the object which is on the same side as the eccentric telescope, that is, the distance of the left hand object in our instruments, enter the Table and take a correction, to which you prefix the sign +; with the distance of the right hand object, take a second correction, which is to have the sign minus —.

Example. Suppose the distance of the left hand object to be 5000 fathoms, and the right hand object to be distant 22,000 fathoms, and the eccentricity to the left;

	Fathoms.	
Dist. of object to the left	5000	+ 0″.40
. . . . right	22,000	— 0″.09
Total corrrection		+ 0″.31

The above correction arises from the mechanical construction of the instrument; but the principal correction is to reduce the observed oblique angle to the horizontal angle, for which purpose the subjoined Tables are added. They were calculated by the French astronomers, who have endeavoured by every means in their power to extend and facilitate the use of this valuable instrument.

Let A = the angle of position, or the observed angle.
H = the altitude of the signal A.
h = the altitude of the signal B.

Let $n = \sin.^2 \tfrac{1}{2}(H+h) \text{ tang. } \tfrac{1}{2} A - \sin.^2 \tfrac{1}{2}(H-h) \cot. \tfrac{1}{2} A$.

Then the cor. $x = n$, sec. H, sec. h.

If the zenith distances differ more than 2° or 3° from 90°, the following formula may be employed.

$$\text{Sin.}\tfrac{1}{2}z = \sqrt{\frac{\sin.\left(\frac{C+\partial+\partial'}{2}-\partial\right)\sin.\left(\frac{C+\partial+\partial'}{2}-\partial'\right)}{\sin.\partial - \sin.\partial'}}$$

z being the angle reduced to the horizon, C the angle at the centre, ∂ and ∂' the zenith distances of the signals.

To facilitate this reduction, we have added the tables calculated for this purpose by M. Delambre. By these tables we may at the same time reduce the horizontal angle to that formed by the chords.

The use of these tables will be easily understood by an example.

H + h is the sum of the zenith distances of the observed objects diminished by 180°.

If the sum should be less than 180°, H + h is the remainder required to complete 180°.

H — h is always the difference between the two zenith distances.

(H + h) and (H — h) are always considered as positive numbers.

P + Q is the sum of the distances in French toises between the observer and each of the signals.

P — Q is the difference between these distances; (P — Q) is always positive.

With (P + Q) and (P — Q) take in Tab. II. two numbers, to which you always must annex the sign.

With the observed angle, take in Tab. IV. the number, *Tangent*, to which the sign + must be always annexed, and which must be placed under the factor found by H + h.

With the same angle take in the adjoining column, *Cotangent*, to which annex sign —, and place it under the factor found by H — h. Place these same numbers under the factors (P + Q) and (P — Q), as in the example. Make the four requisite multiplications.

The difference of the two first products is the reduction to the horizon, to be applied according to its sign.

The difference of the two last products is the reduction to the chords, to be applied with its proper sign to the horizontal angle.

This last reduction is almost always subtractive, but it sometimes becomes additive, by the fourth product exceeding the third.

In general, the fourth product is nothing, and the third always very small; so that in calculating the reduction, which is indispensable, it is very little more trouble to reduce the angles to the chords. These tables are, in general, quite sufficient for the reduction to the horizon; but, for greater exactness, Table III. is added. The difference of the products, as obtained above, may, by means of this table, be multiplied by sec. H, sec. h, as required by the formula. If greater precision be required, the whole calculation may be repeated with the corrected angle, instead of the observed angle.

To make use of this table, it is necessary to have a plan of the triangles with a scale. The arguments are on one side of the triangle as a base, and the height.

Example.

Observed Angle.	Zenith Distance.	Distance of Signals, in Toises.
32° 20′ 15″.7	A = 89° 41′ 54″.6	A = 18283
	B = 88 49 15.6	B = 24423.
	178 31 10.2	

H + h = 1 28 49.8
H — h = 52 39

	Tab. I.		Tab. II.	
Argument	H + h	H — h	P + Q	P — Q
Factors	+1.669	+0.587	—0.112	—0.003
Tab. IV.	+ 5.99	—7.106	+ 5.99	—7.106
	15021	3522	— 0.67	+0.2
	15021	0587	+ 0.02	
	8345	4109		
			— 0.65 = reduction to the chords.	
	+9.99731	—41.71222		

Observed angle . . . . . . 32° 20′ 15″.7
Reduction to horizon . . . 31.7
Horizontal angle . . . . = 32 19 44.0
Reduction to the chords . — 0.65
Angle of the chords 32 19 43.45

When the depressions are small, we may, instead of the tables, use this formula.

$$x = \left\{\left(90° - \frac{\partial+\partial'}{2}\right) \text{tang.} \tfrac{1}{2}C - \left(\frac{\partial-\partial'}{2}\right)^2 \cot. \tfrac{1}{2}C\right\},$$

sin. 1″,

Example by the Formula.

$\partial = 89° 41′ 54″.6$
$\partial' = 88\ 49\ 15.6$

$\partial + \partial' = 178\ 31\ 10.2$ $\quad \partial - \partial' = 0° 52′ 39″$

$90° - \frac{\partial+\partial'}{2} = 0\ 44\ 24.9$ $\quad \frac{\partial-\partial'}{2} = 0\ 26\ 19.5$

$= 2664″.9 = p$ $\quad = 2579″.5 = q$

Sin. 1″ 4.68557 4.68557
Log. p^2 6.85136 Log. q^2 6.39704
Tang. ½ C 9.46228 Cot. ½ C 0.53764

+ 0.99921 = 9″.98 − 1.62025 = 41″.71
− 41.71

− 31.73 = Reduction required.
32° 20′ 15.70

Reduced angle = 32 19 43.97 the same as above.

TABLES *for reducing Angles measured by the repeating Circle.*

TABLE I.

Reduction of the Angles to the Horizon.

Argument. (H+*h*) and (H−*h*) { Sum and Difference of the Altitude of the Signals.

5000. sin. ver. (H + *h*)

M.	0° +	1° +	2° +
1	0.000	0.787	3.097
2	0.001	0.813	3.148
3	0.002	0.839	3.200
4	0.003	0.866	3.252
5	0.005	0.893	3.305
6	0.007	0.921	3.358
7	0.010	0.949	3.411
8	0.013	0.978	3.465
9	0.017	1.007	3.520
10	0.021	1.036	3.575
11	0.026	1.066	3.630
12	0.030	1.096	3.685
13	0.036	1.127	3.741
14	0.041	1.158	3.798
15	0.047	1.190	3.855
16	0.054	1.222	3.912
17	0.061	1.254	3.970
18	0.068	1.287	4.028
19	0.076	1.320	4.086
20	0.081	1.354	4.145
21	0.093	1.388	4.205
22	0.102	1.422	4,265
23	0.112	1.457	4.325
24	0.122	1.492	4.386
25	0.132	1.528	4.447
26	0.143	1.564	4.508
27	0.154	1.601	4.570
28	0.166	1.638	4.633
29	0.178	1.675	4.695
30	0.190	1.713	4.758
31	0.203	1.751	4.822
32	0.217	1.790	4.886
33	0.230	1.829	4.951
34	0.244	1.869	5.016
35	0.259	1.909	5.081
36	0.274	1.949	5.147
37	0.289	1.990	5.213
38	0.305	2.031	5.280
39	0.321	2.073	5.347
40	0.338	2.115	5.414
41	0.355	2.158	5.482
42	0.373	2.201	5.550
43	0.391	2.244	5.619
44	0.409	2.288	5.688
45	0.428	2.332	5.758
46	0.447	2.376	5.828
47	0.467	2.421	5.899
48	0.487	2.467	5.970
49	0.508	2.513	6.041
50	0.529	2.559	6.112
51	0.550	2.606	6.184
52	0.572	2.653	6.257
53	0.594	2.701	6.330
54	0.617	2.749	6.403
55	0.640	2.797	6.477
56	0.663	2.846	6.551
57	0.687	2.895	6.626
58	0.711	2.945	6.701
59	0.736	2.995	6.776
60	0.761	3.046	6.852

TABLE II.

Arg. (P + Q, and (P − Q.)

Toises. P ± Q	−	Toises. P ± Q.	−
0000	0.000	31000	0.056
1000	0.000	32000	0.060
2000	0.000	33000	0.064
3000	0.001	34000	0.068
4000	0.001	35000	0.072
5000	0.001	36000	0.075
6000	0.002	37000	0.080
7000	0.003	38000	0.085
8000	0.004	39000	0.089
9000	0.005	40000	0.094
10000	0.006	41000	0.098
11000	0.007	42000	0.103
12000	0.008	43000	0.108
13000	0.010	44000	0.113
14000	0.011	45000	0.119
15000	0.013	46000	0.124
16000	0.015	47000	0.129
17000	0.017	48000	0.135
18000	0.019	49000	0.146
19000	0.021	50000	0.146
20000	0.023	51000	0.152
21000	0.026	52000	0.158
22000	0.028	53000	0.164
23000	0.031	54000	0.171
24000	0.034	55000	0.177
25000	0.037	56000	0.184
26000	0.040	57000	0.190
27000	0.043	58000	0.197
28000	0.048	59000	0.204
29000	0.050	60000	0.211
30000	0.053		

TABLE III. Sec. H × sec. *h*.

Arg. H and *h*.

D. M.	0° 0′	0° 30′	1° 0′	1° 30′	2° 0′	2° 30′	3° 0′
	1.00	1.00	1.00	1.00	1.00	1.00	1.00
0 0	00	00	02	03	06	10	14
10	00	01	02	03	06	10	14
20	00	01	02	04	06	10	14
30	00	02	02	04	06	10	14
40	01	02	02	04	07	11	15
50	01	02	03	05	07	11	15
1 0	02	02	03	05	08	11	15
10	02	02	04	06	08	12	16
20	03	03	04	06	09	12	16
30	03	04	05	07	09	13	17
40	04	05	06	08	10	14	18
50	05	05	07	09	11	15	19
2 0	06	06	08	10	12	16	20
10	07	07	09	11	13	17	21
20	08	09	10	12	14	18	22
30	10	10	11	13	16	19	23
40	11	11	12	14	17	20	25
50	12	14	13	16	18	21	26
3 0	14	15	14	17	20	23	27

The cyphers 1.00 at the head of the column are common to all the numbers of the Table.

TABLE IV. Argument. Angle to be reduced.

$\left(\frac{0''.0001}{\sin. 1''}\right)$ Tang. ½ A, and $\left(\frac{0''.0001}{\sin. 1''}\right)$ Cot. ½ A.

Angle D. M.	Tang. +	Cot. −	D. M.	Angle D. M.	Tang. +	Cot. −	D. M.
	″	″			″	″	
12 0	2.17	196.25	168 0	15 0	2.72	156.68	165 0
10	2.20	193.54	167 50	10	2.75	154.93	50
20	2.23	190.90	40	20	2.78	153.23	40
30	2.26	188.34	30	30	2.81	151.56	30
40	2.29	185.84	20	40	2.84	149.93	20
50	2.32	183.40	10	50	2.87	148.33	10
13 0	2.35	181.04	167 0	16 0	2.90	146.77	164 0
10	2.38	178.72	50	10	2.93	145.23	50
20	2.41	176.37	40	20	2.96	143.72	40
30	2.44	174.27	30	30	2.99	142.26	30
40	2.47	172.12	20	40	3.02	140.82	20
50	2.50	170.03	10	50	3.05	139.40	10
14 0	2 53	167.99	166 0	17 0	3.08	138.02	163 0
10	2.56	165.99	50	10	3.11	136.66	50
20	2.60	164.04	40	20	3.14	135.32	40
30	2.63	162.14	30	30	3.18	134.01	30
40	2.66	160.27	20	40	3.21	132.73	20
50	2.69	158.45	10	50	3.24	131.47	10
15 0	2.72	156.68	165 0	18 0	3.27	130.23	162 0
	− Cot.	+ Tang.	D. M. Angle.		− Cot.	+ Tang.	D. M. Angle.

To the constant log. 1.31443. Add Tang. ½ A,
and Cot. ½ A.

The number answering to the sum will be the number of the Table.

TABLE IV.—*continued.*

Angle D. M.	Tang. +	Cot. −	D. M.	Angle D. M.	Tang. +	Cot. −	D. M.
	″	″			″	″	
18 0	3.27	130.23	162 0	27 0	4.95	85.92	153 0
10	3.30	129.02	50	10	4.98	85.37	50
20	3.33	127.82	40	20	5.02	84.83	40
30	3.36	126.65	30	30	5.05	84.30	30
40	3.39	125.50	20	40	5.08	83.77	20
50	3.42	124.37	10	50	5.11	83.25	10
19 0	3.45	123.26	161 0	28 0	5.14	82.74	152 0
10	3.48	122.17	50	10	5.17	82.22	50
20	3.51	121.09	40	20	5.21	81.71	40
30	3.55	120.04	30	30	5.24	81.12	30
40	3.58	119.00	20	40	5.27	80.73	20
50	3.61	117.93	10	50	5.30	80.24	10
20 0	3.64	116.98	160 0	29 0	5.33	79.76	151 0
10	3.67	115.99	50	10	5.36	79.28	50
20	3.70	115.02	40	20	5.40	78.81	40
30	3.73	114.07	30	30	5.43	78.34	30
40	3.76	113.13	20	40	5.46	77.83	20
50	3.79	112.20	10	50	5.49	77.49	10
21 0	3.82	111.29	159 0	30 0	5.53	76.98	150 0
10	3.85	110.39	50	10	5.56	76.53	50
20	3 88	109.51	40	20	5.59	76.09	40
30	3.92	108.64	30	30	5.62	75.66	30
40	3.95	107.79	20	40	5.66	75.23	20
50	3.98	106.94	10	50	5.69	74.80	10
22 0	4.01	105.11	158 0	31 0	5.72	74.38	149 0
10	4.04	105.30	50	10	5.75	73.96	50
20	4 07	104.49	40	20	5.78	73.55	40
30	4.11	103.70	30	30	5.82	73.14	30
40	4.14	102.91	20	40	5.85	72.73	20
50	4.17	102.14	10	50	5.88	72.33	10
23 0	4.20	101.38	157 0	32 0	5.91	71.93	148 0
10	4.23	100.63	50	10	5.94	71.54	50
20	4.26	99.89	40	20	5.98	71.15	40
30	4.29	99.17	30	30	6.01	70.77	30
40	4.32	98.44	20	40	6.04	70.39	20
50	4.35	97.74	10	50	6.07	70.01	10
24 0	4.38	97.04	156 0	33 0	6.11	69.63	147 0
10	4.41	96.35	50	10	6 14	69.26	50
20	4.45	95.67	40	20	6.18	68.90	40
30	4.48	95 00	30	30	6.21	68.54	30
40	4.51	94.34	20	40	6.24	68.16	20
50	4.54	93.68	10	50	6.27	67.82	10
25 0	4.57	93.04	155 0	34 0	6.31	67.47	146 0
10	4.60	92.40	50	10	6.34	67.12	50
20	4.63	91.77	40	20	6.37	66.77	40
30	4.67	91.16	30	30	6.41	66.43	30
40	4.70	90.54	20	40	6.44	66.09	20
50	4.73	89.34	10	50	6.47	65.75	10
26 0	4.76	89.95	154 0	35 0	6.50	65.42	145 0
10	4.79	88.75	50	10	6.54	65.09	50
20	4.82	88.17	40	20	6.57	64.76	40
30	4.86	87.60	30	30	6.60	64.44	30
40	4.89	87.03	20	40	6.64	64.12	20
50	4.92	86.58	10	50	6.67	63.80	10
27 0	4.95	85.92	153 0	36 0	6.70	63.48	144 0
	− Cot.	+ Tang.	D. M. Angle.		− Cot.	+ Tang.	D. M. Angle.

TABLE IV.—*continued.*

Angle D. M.	Tang. +	Cot. —	D. M.	Angle D. M.	Tang. +	Cot. —	D. M.	Angle D. M.	Tang. +	Cot. —	D. M.	Angle D. M.	Tang. +	Cot. —	D. M.
	″	″			″	″			″	″			″	″	
36 0	6.70	63.48	144 0	45 0	8.54	49.80	135 0	54 0	10.51	40.48	126 0	63 0	12.64	33.66	117 0
10	6.73	63.17	50	10	8.57	49.59	50	10	10.54	40.33	50	10	12.68	33.55	50
20	6.77	62.86	40	20	8.61	49.39	40	20	10.58	40.19	40	20	12.72	33.44	40
30	6.80	62.55	30	30	8.65	49.19	30	30	10.62	40.04	30	30	12.76	33.33	30
40	6.84	62.25	20	40	8.68	48.99	20	40	10.66	39.90	20	40	12.80	33.22	20
50	6.87	61.95	10	50	8.72	48.79	10	50	10.70	39.76	10	50	12.84	33.11	10
37 0	6.90	61.65	143 0	46 0	8.76	48.59	134 0	55 0	10.74	39.62	125 0	64 0	12.89	33.01	116 0
10	6.93	61.35	50	10	8.79	48.39	50	10	10.77	39.48	50	10	12.93	32.90	50
20	6.97	61.06	40	20	8.83	48.20	40	20	10.81	39.34	40	20	12.97	32.80	40
30	7.01	60.77	30	30	8.87	48.01	30	30	10.85	39.20	30	30	13.01	32.69	30
40	7.04	60.48	20	40	8.90	47.82	20	40	10.89	39.06	20	40	13.05	32.58	20
50	7.07	60.19	10	50	8.94	47.63	10	50	10.93	38.92	10	50	13.09	32.48	10
38 0	7.10	59.90	142 0	47 0	8.97	47.44	133 0	56 0	10.97	38.79	124 0	65 0	13.14	32.38	115 0
10	7.13	59.62	50	10	9.00	47.25	50	10	11.00	38.65	50	10	13.18	32.28	50
20	7.17	59.34	40	20	9.04	47.06	40	20	11.04	38.52	40	20	13.22	32.17	40
30	7.21	59.06	30	30	9.07	46.88	30	30	11.08	38.39	30	30	13.26	32.07	30
40	7.24	58.79	20	40	9.11	46.69	20	40	11.12	38.25	20	40	13.30	31.97	20
50	7.27	58.52	10	50	9.14	46.51	10	50	11.16	38.12	10	50	13.34	31.87	10
39 0	7.30	58.25	141 0	48 0	9.18	46.33	132 0	57 0	11.20	37.99	123 0	66 0	13.39	31.76	114 0
10	7.33	57.98	50	10	9.21	46.15	50	10	11.23	37.86	50	10	13.43	31.66	50
20	7.37	57.71	40	20	9.25	45.97	40	20	11.27	37.73	40	20	13.47	31.56	40
30	7.40	57.45	30	30	9.29	45.79	30	30	11.31	37.60	30	30	13.52	31.46	30
40	7.44	57.19	20	40	9.32	45.61	20	40	11.35	37.47	20	40	13.56	31.36	20
50	7.47	56.93	10	50	9.36	45.43	10	50	11.39	37.34	10	50	13.60	31.26	10
40 0	7.51	56.67	140 0	49 0	9.40	45.26	131 0	58 0	11.43	37.21	122 0	67 0	13.65	31.16	113 0
10	7.54	56.42	50	10	9.43	45.08	50	10	11.47	37.08	50	10	13.69	31.06	50
20	7.57	56.17	40	20	9.47	44.91	40	20	11.51	36.96	40	20	13.73	30.96	40
30	7.61	55.92	30	30	9.51	44.71	30	30	11.55	36.83	30	30	13.78	30.87	30
40	7.64	55.67	20	40	9.54	44.57	20	40	11.59	36.71	20	40	13.82	30.77	20
50	7.68	55.42	10	50	9.58	44.40	10	50	11.63	36.58	10	50	13.86	30.67	10
41 0	7.71	55.17	139 0	50 0	9.62	44.23	130 0	59 0	11.67	36.46	121 0	68 0	13.91	30.58	112 0
10	7.75	54.93	50	10	9.65	44.06	50	10	11.71	36.33	50	10	13.95	30.48	50
20	7.78	54.69	40	20	9.69	43.90	40	20	11.75	36.21	40	20	13.99	30.39	40
30	7.81	54.45	30	30	9.73	43.73	30	30	11.79	36.09	30	30	14.03	30.29	30
40	7.85	54.21	20	40	9.76	43.57	20	40	11.83	35.91	20	40	14.08	30.20	20
50	7.88	53.97	10	50	9.80	43.40	10	50	11.87	35.75	10	50	14.12	30.10	10
42 0	7.92	53.73	138 0	51 0	9.84	43.24	129 0	60 0	11.91	35.73	120 0	69 0	14.17	30.01	111 0
10	7.95	53.50	50	10	9.87	43.08	50	10	11.95	35.61	50	10	14.21	29.91	50
20	7.98	53.27	40	20	9.91	42.92	40	20	11.99	35.49	40	20	14.26	29.82	40
30	8.02	53.04	30	30	9.95	42.76	30	30	12.03	35.37	30	30	14.30	29.73	30
40	8.05	52.81	20	40	9.98	42.60	20	40	12.07	35.25	20	40	14.35	29.64	20
50	8.08	52.58	10	50	10.02	42.44	10	50	12.11	35.13	10	50	14.39	29.55	10
43 0	8.12	52.36	137 0	52 0	10.06	42.29	128 0	61 0	12.15	35.02	119 0	70 0	14.44	29.46	110 0
10	8.15	52.14	50	10	10.09	42.13	50	10	12.19	34.90	50	10	14.48	29.37	50
20	8.19	51.92	40	20	10.13	41.98	40	20	12.23	34.79	40	20	14.53	29.28	40
30	8.22	51.70	30	30	10.17	41.82	30	30	12.27	34.67	30	30	14.57	29.19	30
40	8.26	51.48	20	40	10.20	41.67	20	40	12.31	34.56	20	40	14.62	29.10	20
50	8.29	51.26	10	50	10.24	41.52	10	50	12.35	34.44	10	50	14.66	29.01	10
44 0	8.33	51.05	136 0	53 0	10.28	41.37	127 0	62 0	12.39	34.33	118 0	71 0	14.71	28.92	109 0
10	8.36	50.84	50	10	10.31	41.22	50	10	12.43	34.21	50	10	14.75	28.83	50
20	8.40	50.63	40	20	10.35	41.97	40	20	12.47	34.10	40	20	14.80	28.74	40
30	8.43	50.42	30	30	10.39	40.92	30	30	12.51	33.99	30	30	14.85	28.65	30
40	8.47	50.21	20	40	10.43	40.77	20	40	12.56	33.88	20	40	14.89	28.56	20
50	8.50	50.00	10	50	10.47	40.62	10	50	12.60	33.77	10	50	14.98	28.47	10
45 0	8.54	49.80	135 0	54 0	10.51	40.48	126 0	63 0	12.64	33.66	117 0	72 0	14.99	28.39	108 0
	— Cot.	+ Tang.	D. M. Angle.		— Cot.	+ Tang.	D. M. Angle.		— Cot.	+ Tang.	D. M. Angle.		— Cot.	+ Tang.	D. M. Angle.

TABLE IV.—*Continued.*

Angle D. M.	Tang. +	Cot. —	D. M.	Angle D. M.	Tang. +	Cot. —	D. M.
	″	″			″	″	
72 0	14.99	28.39	108 0	81 0	17.62	24.15	99 0
10	15.03	28.30	50	10	17.67	24.08	50
20	15.08	28.21	40	20	17.72	24.01	40
30	15.12	28.13	30	30	17.77	23.94	30
40	15.17	28.04	20	40	17.82	23.87	20
50	15.21	27.95	10	50	17.87	23.80	10
73 0	15.26	27.87	107 0	82 0	17.93	23.73	98 0
10	15.30	27.78	50	10	17.98	23.66	50
20	15.35	27.70	40	20	18.03	23.59	40
30	15.40	27.62	30	30	18.09	23.52	30
40	15.44	27.53	20	40	18.14	23.45	20
50	15.49	27.45	10	50	18.19	23.38	10
74 0	15.54	27.37	106 0	83 0	18.25	23.31	97 0
10	15.58	27.28	50	10	18.30	23.24	50
20	15.63	27.20	40	20	18.35	23.17	40
30	15.68	27.12	30	30	18.40	23.11	30
40	15.73	27.04	20	40	18.46	23.04	20
50	15.78	26.96	10	50	18.51	22.97	10
75 0	15.83	26.88	105 0	84 0	18.57	22.91	96 0
10	15.87	26.80	50	10	18.62	22.84	50
20	15.92	26.72	40	20	18.68	22.77	40
30	15.97	26.64	30	30	18.73	22.70	30
40	16.01	26.56	20	40	18.79	22.63	20
50	16.06	26.48	10	50	18.84	22.56	10
76 0	16.11	26.40	104 0	85 0	18.90	22.50	95 0
10	16.16	26.32	50	10	18.95	22.43	50
20	16.21	26.24	40	20	19.01	22.37	40
30	16.26	26.16	30	30	19.06	22.30	30
40	16.31	26.08	20	40	19.12	22.24	20
50	16.36	26.00	10	50	19.17	22.18	10
77 0	16.41	25.93	103 0	86 0	19.23	22.12	94 0
10	16.45	25.85	50	10	19.28	22.05	50
20	16.50	25.77	40	20	19.34	21.99	40
30	16.55	25.70	30	30	19.40	21.92	30
40	16.60	25.62	20	40	19.45	21.86	20
50	16.65	25.54	10	50	19.51	21.80	10
78 0	16.70	25.47	102 0	87 0	19.56	21.74	93 0
10	16.75	25.39	50	10	19.62	21.67	50
20	16.80	25.32	40	20	19.68	21.61	40
30	16.85	25.29	30	30	19.74	21.54	30
40	16.90	25.17	20	40	19.80	21.48	20
50	16.95	25.09	10	50	19.86	21.42	10
79 0	17.00	25.02	101 0	88 0	19.92	21.36	92 0
10	17.05	24.94	50	10	19.97	21.29	50
20	17.10	24.87	40	20	20.03	21.23	40
30	17.15	24.80	30	30	20.09	21.17	30
40	17.20	24.72	20	40	20.15	21.11	20
50	17.25	24.65	10	50	20.21	21.05	10
80 0	17.31	24.58	100 0	89 0	20.27	20.99	91 0
10	17.36	24.50	50	10	20.33	20.93	50
20	17.41	24.43	40	20	20.39	20.87	40
30	17.46	24.36	30	30	20.45	20.81	30
40	17.51	24.29	20	40	20.51	20.75	20
50	17.56	24.22	10	50	20.57	20.69	10
81 0	17.62	24.15	99 0	90 0	20.63	20.63	90 0
	— Cot.	+ Tang.	D. M. Angle.		— Cot	+ Tang.	D. M. Angle.

It has been shewn, how, from the oblique angle of two objects, A and B, as seen from a point C, we can obtain the horizontal or azimuthal angle; but it is necessary, for the truth of our conclusion, that the point C remain the same for the zenith distance observations as for the oblique angles. If we examine the construction of the repeating circle, we shall find that its centre C is lower in the vertical than in the horizontal position: this circumstance seems to have been overlooked by the French astronomers; or they have probably included it in the requisite correction employed for the difference of height of the signal above the centre of the circle. To apply this correction, we are to consider what would be the zenith distance of an object if the centre of the instrument were elevated or depressed a given quantity.

The correction is as follows:

Let *d* H be the difference of altitude of the two positions, D the distance of the observed signal, ∂ the zenith distance required to be corrected; then the corrected distance will be

$$\partial + \left(\frac{\partial H}{D}\right)\frac{\sin.\partial}{\sin.1''}$$

If the instrument is advanced before the signal, the distance corrected will be

$$\partial + \left(\frac{r}{D}\right)\frac{\cos.\partial}{\sin.1''};$$

r being the distance of the centre.

In Mr Troughton's circles the centre of the circle is 5.4 or 5.5 inches lower in the vertical than in the horizontal position.

SECT. III. *On the Use of the Repeating Circle as an Astronomical Instrument.*

Use of the repeating circle as an astronomical instrument.

We have seen that the principal advantage of the repeating circle consists in the contrivance by which the angular distance of two points may be measured with extreme accuracy. Now, it is evident, that if we could always command a visible terrestrial object, placed exactly either in the north or south point of the horizon, and if at the same time a star could remain stationary on the meridian, its meridian altitude might be obtained by the process above described, without farther explanation; for the angular distance between the star and the terrestrial object would be the meridian altitude required. But neither of these conditions can be obtained. The stars are apparently in constant motion; and a terrestrial object as above defined, (even if it could be obtained,) would be invisible by night; hence arise two difficulties, the one produced by the motion of the star, and capable of being obviated by appropriate tables, the other is remedied by substituting a spirit level instead of the back telescope. This substitution will effect some little change in the mode of observing which we shall shortly describe, and will require some few additional verifications, (see page 501, col. 1.) of which the following are the most essential.

Verification of the Verniers.

Verification of the verniers.

Call the vernier which is connected with the clamp-screw No. 1, the others No. 2, No. 3, No. 4, in succession, according to the divisions of the circle. Place No. 1. at zero, read off all the others, and set down their deviations with the sign + or —, as they exceed or fall short of their respective divisions, add these quantities, and divide the sum by 4. This quotient may be called the index error, and must be applied to the observed angle with a contrary sign. For example,

No. 1. . . . . 00"
2. . . . . + 05
3. . . . . + 10
4. . . . . − 3

4) + 12

+ 3" Index error to be subtracted from the observed angle: then suppose at the end of an observation that the verniers stand thus:

No. 1. . . . . 183° 14 10"
2. . . . 7
3. . . . 14
4. . . . 20

4) 51

183 14 12.77
Deduct the Index error − 3

True angle 183 14 9.77

As the level and the front telescope turn round one common axis, independent of each other, it should be remembered, that the circle must always be fixed to, and form one piece with one of the other two. In the front observation which begins the series, it must be considered as forming one piece with the front telescope, and care must be taken on no account to touch the screw that alters their relative position to each other. On the contrary, in the reverse observation, the circle must be considered as forming one piece with the level, and equal care taken not to separate them from their fixed position. The great danger to an unexperienced observer with this instrument is, that his whole series of observations may be destroyed by improperly releasing the piece which ought to remain fixed.

But a little consideration and practice will render this operation easy and familiar.

A well regulated clock or watch is necessary for these observations; and they will be rendered much easier, if an assistant attends to the level, while the observer bisects the star.

It may not be improper to remark, that it is of more importance to make good observations, than to make a great number. The errors of division are so small in our best constructed instruments, that a very few repetitions will render their effect quite insensible. The observer will soon find that it is the error of observation he has to contend with, arising from the smallness of the radius, and want of power in the telescope; for this reason, the observations should not be hurried, but sufficient time allowed for examining the true position of the level and the accurate bisection of the star.

The corrections to be applied to the observations made with the repeating circle are, for the purpose of reducing the meridian altitude, from that observed a short time before or after the passage of the star over the meridian. The hour angle, or distance of the star from the meridian, must, therefore, be correctly known; and in proportion as the rate of the clock is well ascertained, may the observations be extended with confidence on each side of the meridian.

The pole-star, from the slowness of its motion, being the best adapted for observation with this instrument, we have given a table of corrections for that particular star, extending to half an hour from the meridian, beyond which the observations should never extend. This table having been calculated for the latitude of Paris some years since, the numbers must now for the latitude of Greenwich be diminished $\frac{1}{10}$th, that is, the whole correction multiplied by 0.95; and for the inferior passage of the star the whole correction must be multiplied by 0.88.

Tables II. and III. are general tables for any star, and for any latitude; they were calculated by Delambre from the following formula:

Make $P =$ The hour angle.
$L =$ Latitude.
$D =$ Declination of the star.
$x =$ Corrections required.

If the star pass southward of the zenith $x = -\frac{2\sin.^2\frac{1}{2}P, \cos. D, \cos. L}{\sin.(L-D)\sin. 1''} \cdot \frac{1}{2}\left(\frac{2\sin.^4\frac{1}{2}P, \cos. D, \cos. L}{\sin. L-D \sin. 1''}\right)^2 \cot. L-D \sin. 1''$.

If the declination be south, change the sign of D.

If the star passes to the north of the zenith, for $L-D$ substitute $D-L$, and change the sign of the terms.

But if the star passes below the pole, $D+L$ must be substituted for $D-L$, the signs remaining the same.

The numbers contained in these tables are the factors $\frac{2\sin.^2\frac{1}{2}P}{\sin. 1''}$, and $\frac{2\sin.^4\frac{1}{2}P}{\sin. 1''}$, the remainder of the calculation is thus reduced to finding the value of the other factors.

$$\left(\frac{\cos. D, \cos. L}{\sin. D-L}\right) = F,$$

and

$$\left(\frac{\cos. D, \cos. L}{\sin. D-L}\right)^2 \cot. D-L = f.$$

Example of an Observation of the Pole Star, by the Repeating Circle, Dec. 4th 1807.

Distance from the Meridian.		Corrrect. by Table I.					
'	"	"					"
11	30	8.5					
10	20	6.9					
7	45	3.8					
6	30	2.7	147°	5'	50"		
3		0.6					
1	40	0.2					
1	30	0.2					
4	20	1.2	294	11	00		
7		3.2					
8	40	4.8	70	43	58		
12		9.3					
16	30	17.5	81	16	54=1st Vernier		00
					50=2d	....	− 4
		Sum 58.9			58=3d	....	+ 4
					60=4th	....	+ 6
							+ 6
							+ 1.5

58.9= Sum of the corrections.
2.9= $\frac{1}{10}$th.

12)56".0 cor. diminished $\frac{1}{10}$th.

4.7 divided by the number of observations.

At the end of 12 observations, the instrument gave	81° 16′ 55″.5
Index error	3.3
	81 16 58.8
	360
	12)441 16 58.8
	36 46 24.9
Correction	4.7
	36 46 20.2
The first four observations give	36 46 22.2
eight	36 46 19.6
ten	36 46 21.0
twelve	36 46 20.2

Example of the Use of the general Tables.

Hour Angle.	Tab. II.	Tab. III.	
11 30	259.6	0.163	D=88° 17′
10 20	209.6	0.107	L=51 30.21
7 45	117.9	0.033	
6 30	83.0	0.016	
3 0	17.7	0.001	
1 40	5.4	0.000	
1 30	4.4	0.000	
4 20	36.9	0.003	
7 0	96.2	0.022	
8 40	147.5	0.053	
12 0	280.7	0.194	
16 30	534.4	0.700	
	1793.3	1.292	

$$F=\frac{\cos.\ D,\ \cos.\ L}{\sin.\ (D-L)}\quad f=\left(\frac{\cos.\ D,\ \cos.\ L}{\sin.\ D-L}\right)^2 \cot.\ D-L$$

Log. 1793.3=3.25358	Log. 1.292=0.11126
Co. log. 12. =8.92082	Co. log. 12=8.92082
Log. F =8.49337	Log. *f* =7.11313
+4.″65=0.66777	6.14521

Tab. II. +4.″65
III. —0.″00

+4″65=correction, which is very nearly the same as in the preceding example.

N. B. In using the following Table for observations above the Pole, we must multiply the correction found by the Table by 0.95; and for observations below the Pole by 0.88.

Tables for facilitating the Use of the Repeating Circle.

Table I. Containing the change in the Altitude of the Pole Star, for half an hour on each side of the Meridian.

	0′	1′	2′	3′	4′	5′
0″	0″0	0″1	0″3	0″6	1″0	1″6
1	0.0	0.1	0.3	0.6	1.0	1.6
2	0.0	0.1	0.3	0.6	1.0	1.6
3	0.0	0.1	0.3	0.6	1.1	1.6
4	0.0	0.1	0.3	0.6	1.1	1.7
5	0.0	0.1	0.3	0.6	1.1	1.7
6	0.0	0.1	0.3	0.6	1.1	1.7
7	0.0	0.1	0.3	0.6	1.1	1.7
8	0.0	0.1	0.3	0.6	1.1	1.7
9	0.0	0.1	0.3	0.6	1.1	1.7
10	0.0	0.1	0.3	0.6	1.1	1.7
11	0.0	0.1	0.3	0.6	1.1	1.7
12	0.0	0.1	0.3	0.7	1.1	1.7
13	0.0	0.1	0.3	0.7	1.1	1.8
14	0.0	0.1	0.3	0.7	1.2	1.8
15	0.0	0.1	0.3	0.7	1.2	1.8
16	0.0	0.1	0.3	0.7	1.2	1.8
17	0.0	0.1	0.3	0.7	1.2	1.8
18	0.0	0.1	0.3	0.7	1.2	1.8
19	0.0	0.1	0.3	0.7	1.2	1.8
20	0.0	0.1	0.4	0.7	1.2	1.8
21	0.0	0.1	0.4	0.7	1.2	1.9
22	0.0	0.1	0.4	0.7	1.2	1.9
23	0.0	0.1	0.4	0.7	1.2	1.9
24	0.0	0.1	0.4	0.7	1.2	1.9
25	0.0	0.1	0.4	0.8	1.2	1.9
26	0.0	0.1	0.4	0.8	1.2	1.9
27	0.0	0.1	0.4	0.8	1.3	1.9
28	0.0	0.1	0.4	0.8	1.3	1.9
29	0.0	0.2	0.4	0.8	1.3	1.9
30	0.0	0.2	0.4	0.8	1.3	1.9
31	0.0	0.2	0.4	0.8	1.3	2.0
32	0.0	0.2	0.4	0.8	1.3	2.0
33	0.0	0.2	0.4	0.8	1.3	2.0
34	0.0	0.2	0.4	0.8	1.4	2.0
35	0.0	0.2	0.4	0.8	1.4	2.0
36	0.0	0.2	0.4	0.8	1.4	2.0
37	0.0	0.2	0.4	0.8	1.4	2.0
38	0.0	0.2	0.4	0.9	1.4	2.0
39	0.0	0.2	0.5	0.9	1.4	2.0
40	0.0	0.2	0.5	0.9	1.4	2.1
41	0.0	0.2	0.5	0.9	1.4	2.1
42	0.0	0.2	0.5	0.9	1.4	2.1
43	0.0	0.2	0.5	0.9	1.4	2.1
44	0.0	0.2	0.5	0.9	1.4	2.1
45	0.0	0.2	0	0.9	1.5	2.1
46	0.0	0.2	0.5	0.9	1.5	2.2
47	0.0	0.2	0.5	0.9	1.5	2.2
48	0.0	0.2	0.5	0.9	1.5	2.2
49	0.0	0.2	0.5	0.9	1.5	2.2
50	0.0	0.2	0.5	1.0	1.5	2.2
51	0.0	0.2	0.5	1.0	1.5	2.2
52	0.1	0.2	0.5	1.0	1.5	2.2
53	0.1	0.2	0.5	1.0	1.5	2.2
54	0.1	0.2	0.5	1.0	1.5	2.2
55	0.1	0.2	0.6	1.0	1.6	2.3
56	0.1	0.2	0.6	1.0	1.6	2.3
57	0.1	0.2	0.6	1.0	1.6	2.3
58	0.1	0.3	0.6	1.0	1.6	2.3
59	0.1	0.3	0.6	1.0	1.6	2.3
60	0.1	0.3	0.6	1.0	1.6	2.3

TABLE I.—*Continued.*

Of the change of Altitude of the Pole Star, for Half an Hour on each side the Meridian.

	6′	7′	8′	9′	10′	11′	12′	13′	14′	15′	16′	17′
0″	2″3	3″2	4″1	5″2	6″4	7″8	9″3	10.9	12″6	14″5	16″5	18″6
1	2.3	3.2	4.1	5.2	6.5	7.8	9.3	10.9	12.6	14.5	16.5	18.6
2	2.3	3.2	4.1	5.3	6.5	7.8	9.3	10.9	12.7	14.5	16.5	18.7
3	2.3	3.2	4.2	5.3	6.5	7.9	9.4	11.0	12.7	14.6	16.6	18.7
4	2.4	3.2	4.2	5.3	6.5	7.9	9.4	11.0	12.7	14.6	16.6	18.7
5	2.4	3.2	4.2	5.3	6.5	7.9	9.4	11.0	12.8	14.6	16.6	18.8
6	2.4	3.2	4.2	5.3	6.6	7.9	9.5	11.0	12.8	14.7	16.7	18.8
7	2.4	3.2	4.2	5.4	6.6	8.0	9.5	11.1	12.8	14.7	16.7	18.8
8	2.4	3.3	4.3	5.4	6.6	8.0	9.5	11.1	12.9	14.7	16.7	18.9
9	2.4	3.3	4.3	5.4	6.6	8.0	9.5	11.1	12.9	14.8	16.8	18.9
10	2.4	3.3	4.3	5.4	6.6	8.0	9.6	11.2	12.9	14.8	16.8	19.0
11	2.5	3.3	4.3	5.4	6.7	8.1	9.6	11.2	13.0	14.8	16.8	19.0
12	2.5	3.3	4.3	5.4	6.7	8.1	9.6	11.2	13.0	14.9	16.9	19.0
13	2.5	3.3	4.3	5.5	6.7	8.1	9.6	11.2	13.0	14.9	16.9	19.1
14	2.5	3.3	4.4	5.5	6.7	8.1	9.7	11.3	13.1	14.9	17.0	19.1
15	2.5	3.4	4.4	5.5	6.8	8.2	9.7	11.3	13.1	15.0	17.0	19.1
16	2.5	3.4	4.4	5.5	6.8	8.2	9,7	11.3	13.1	15.0	17.0	19.2
17	2.5	3.4	4.4	5.6	6.8	8.2	9.7	11.4	13.1	15.0	17.1	19.2
18	2.6	3.4	4.4	5.6	6.8	8.2	9.8	11.4	13,2	15.1	17.1	19.2
19	2.6	3.4	4.4	5.6	6.8	8.2	9.8	11.4	13,2	15.1	17.1	19.3
20	2.6	3.4	4.4	5.6	6.9	8.3	9.8	11.4	13.2	15.1	17.2	19.3
21	2.6	3.5	4.5	5.6	6.9	8.3	9.8	11.5	13.3	15.2	17.2	19.4
22	2.6	3.5	4.5	5.7	6.9	8.3	9.9	11.5	13.3	15.2	17.2	19.4
23	2.6	3.5	4.5	5.7	6.9	8.3	9.9	11.5	13.3	15.2	17.3	19.4
24	2.6	3.5	4.5	5.7	7.0	8.4	9.9	11.6	13.4	15.3	17.3	19.5
25	2.7	3.5	4.5	5.7	7.0	8.4	9.9	11.6	13.4	15.3	17.3	19.5
26	2.7	3.5	4.6	5.7	7.0	8.4	10.0	11.6	13.4	15.3	17.4	19.5
27	2.7	3.6	4.6	5.7	7.0	8.4	10.0	11.6	13.5	15.4	17.4	19.6
28	2.7	3.6	4.6	5.8	7.0	8.5	10.0	11.7	13.5	15.4	17.4	19.6
29	2.7	3.6	4.6	5.8	7.1	8.5	10.1	11.7	13.5	15.4	17.5	19.7
30	2.7	3.6	4.6	5.8	7.1	8.5	10.1	11.7	13.5	15.5	17.5	19.7
31	2.7	3.6	4.7	5.8	7.1	8.6	10.1	11.8	13.6	15.5	17.5	19.7
32	2.7	3.6	4.7	5.8	7.1	8.6	10.1	11.8	13.6	15.5	17.6	19.8
33	2.8	3.7	4.7	5.9	7.2	8.6	10.2	11.8	13.6	15.6	17.6	19.8
34	2.8	3.7	4.7	5.9	7.2	8.6	10.2	11.9	13.7	15.6	17.7	19.8
35	2.8	3.7	4.7	5.9	7.2	8.7	10.2	11.9	13.7	15.6	17.7	19.9
36	2.8	3.7	4.8	5.9	7.2	8.7	10.2	11.9	13.7	15.7	17.7	19.9
37	2.8	3.7	4.8	5.9	7.3	8.7	10.3	11.9	13.8	15.7	17.8	20.0
38	2.8	3.7	4.8	6.0	7.3	8.7	10.3	12.0	13.8	15.7	17.8	20.0
39	2.8	3.7	4.8	6.0	7.3	8.8	10.3	12.0	13.8	15.8	17.8	20.0
40	2.9	3.8	4.8	6.0	7.3	8.8	10.3	12.0	13.9	15.8	17.9	20.1
41	2.9	3.8	4.8	6.0	7.3	8.8	10.4	12.1	13.9	15.8	17.9	20.1
42	2.9	3.8	4.9	6.1	7.4	8.8	10.4	12.1	13.9	15.9	17.9	20.1
43	2.9	3.8	4.9	6.1	7.4	8.9	10.4	12.1	13.9	15.9	18.0	20.2
44	2.9	3 8	4.9	6.1	7.4	8.9	10.5	12.2	14.0	15.9	18.0	20.2
45	2.9	3.8	4.9	6.1	7.4	8.9	10.5	12.2	14.0	16.0	18.1	20.3
46	2.9	3.9	4.9	6.1	7.5	8.9	10.5	12.2	14.0	16.0	18.1	20.3
47	3.0	3.9	5.0	6.2	7.5	9.0	10.5	12.2	14.1	16.0	18.1	20.3
48	3.0	3.9	5.0	6.2	7.5	9.0	10.6	12.3	14.1	16.1	18.2	20.4
49	3.0	3.9	5.0	6.2	7.5	9.0	10.6	12.3	14.1	16.1	18.2	20.4
50	3.0	3.9	5.0	6.2	7.6	9.0	10.6	12.3	14.2	16.1	18.2	20.5
51	3.0	3.9	5.0	6.2	7.6	9.1	10.7	12.4	14.2	16.2	18.3	20.5
52	3.0	4.0	5.1	6.3	7.6	9.1	10.7	12.4	14.2	16.2	18.3	20.5
53	3.0	4.0	5.1	6.3	7.6	9.1	10.7	12.4	14.3	16.2	18.3	20.6
54	3.1	4.0	5.1	6.3	7.7	9.1	10.7	12.5	14.3	16.3	18.4	20.6
55	3.1	4.0	5.1	6.3	7.7	9.2	10.8	12.5	14.3	16.3	18.4	20.6
56	3.1	4.0	5.1	6.3	7.7	9.2	10.8	12.5	14.4	16.3	18.4	20.7
57	3.1	4.0	5.2	6.4	7.7	9.2	10.8	12.5	14.4	16.4	18.5	20.7
58	3.1	4.0	5.2	6.4	7.7	9.2	10.9	12.6	14.4	16.4	18.5	20.8
59	3.1	4.1	5.2	6.4	7.8	9.3	10.9	12.6	14.4	16.4	18.6	20.8
60	3.2	4.1	5.2	6.4	7.8	9.3	10.9	12.6	14.5	16.5	18.6	20.8

CIRCLE.

TABLE I.—*Continued.*

Of the change of Altitude of the Pole Star, for Half an Hour on each side of the Meridian.

	18′	19′	20′	21′	22′	23′	24′	25′	26′	27′	28′	29′
0″	20″8	23″2	25″7	28″3	31″1	34″0	37″0	40.2	43″4	46″8	50″4	54″0
1	20.9	23.3	25.8	28.4	31.1	34.0	37.1	40.2	43.5	46.9	50.4	54.1
2	20.9	23.3	25.8	28.4	31.2	34.1	37.1	40.3	43.5	46.9	50.5	54.1
3	21.0	23.3	25.8	28.5	31.2	34.1	37.2	40.3	43.6	47.0	50.5	54.2
4	21.0	23.4	25.9	28.5	31.3	34.2	37.2	40.4	43.7	47.1	50.6	54.2
5	21.0	23.4	25.9	28.6	31.3	34.2	37.3	40.4	43.7	47.1	50.7	54.3
6	21.1	23.5	26.0	28.6	31.4	34.3	37.3	40.5	43.8	47.1	50.7	54.4
7	21.1	23.5	26.0	28.7	31.4	34.3	37.4	40.5	43.8	47.2	50.8	54.5
8	21.1	23.5	26.1	28.7	31.5	34.4	37.4	40.6	43.9	47.3	50.8	54.5
9	21.2	23.6	26.1	28.7	31.5	34.4	37.5	40.6	43.9	47.4	50.9	54.6
10	21.2	23.6	26.1	28.8	31.6	34.5	37.5	40.7	44.0	47.4	51.0	54.6
11	21.3	23.7	26.2	28.8	31.6	34.5	37.6	40.7	44.0	47.5	51.0	54.7
12	21.3	23.7	26.2	28.9	31.7	34.6	37.6	40.8	44.1	47.5	51.1	54.8
13	21.3	23.8	26.3	28.9	31.7	34.6	37.7	40.9	44.2	47.6	51.1	54.8
14	21.4	23.8	26.3	29.0	31.8	34.7	37.7	40.9	44.2	47.6	51.2	54.9
15	21.4	23.8	26.4	29.0	31.8	34.7	37.8	41.0	44.3	47.7	51.3	55.0
16	21.5	23.9	26.4	29.1	31.9	34.8	37.8	41.0	44.3	47.8	51.3	55.0
17	21.5	23.9	26.4	29.1	31.9	34.8	37.9	41.1	44.4	47.8	51.4	55.1
18	21.5	24.0	26.5	29.2	32.0	34.9	37.9	41.1	44.4	47.8	51.4	55.1
19	21.6	24.0	26.5	29.2	32.0	34.9	38.0	41.2	44.5	47.9	51.5	55.2
20	21.6	24.0	26.6	29.3	32.1	35 0	38.0	41.2	44.6	48.0	51.6	55.3
21	21.6	24.1	26.6	29.3	32.1	35.0	38.1	41.3	44.6	48.0	51.6	55.3
22	21.7	24.1	26.7	29.3	32.1	35.1	38.1	41.3	44.7	48.1	51.7	55.4
23	21.7	24.2	26.7	29.4	32.2	35.1	38.2	41.4	44.7	48.2	51.7	55.4
24	21.8	24.2	26.7	29.4	32.2	35.2	38.2	41.4	44.8	48.2	51.8	55.5
25	21.8	24.2	26.8	29 5	32.3	35.2	38.3	41.5	44 8	48.3	51.9	55.6
26	21.8	24.3	26.8	29.5	32.3	35.3	38.4	41.6	44.9	48.4	51.9	55.6
27	21.9	24.3	26.9	29.5	32.4	35.3	38.4	41.6	44.9	48.3	52.0	55.7
28	21.9	24.4	26.9	29.6	32.4	35.4	38.5	41.7	45.0	48.5	52.0	55.8
29	22.0	24.4	27.0	29.7	32.5	35.4	38.5	41.7	45.0	48.5	52.1	55.8
30	22.0	24.5	27.0	29.7	32.5	35 5	38.6	41.8	45.1	48.6	52.2	55.9
31	22.0	24.5	27.1	29.8	32.6	35.5	38.6	41.8	45.2	48.6	52.2	56.0
32	22.1	24.5	27.1	29.8	32.6	35.6	38.7	41.9	45.2	48.7	52.3	56.0
33	22 1	24.6	27.1	29.8	32.7	35.6	38.7	41.9	45.3	48.7	52.4	56.1
34	22.2	24.6	27.2	29.9	32.7	35.7	38.8	42.0	45.3	48.8	52.4	56.1
35	22.2	24.7	27.2	29.9	32.8	35.7	38.8	42.0	45.4	48.9	52.5	56.2
36	22.2	24.7	27.3	30.0	32.8	35.8	38.9	42.1	45.5	48.9	52.5	56.3
37	22 3	24.7	27.3	30.0	32.9	35.8	38.9	42.2	45 5	49.0	52.6	56.3
38	22 3	24.8	27.4	30.1	32.9	35 9	39.0	42.2	45 6	49.0	52.7	56.4
39	22.4	24.8	27.4	30.1	33.0	35.9	39.0	42.3	45.6	49.1	52.7	56.5
40	22.4	24.9	27.5	30.2	33.0	36 0	39.1	42.3	45.7	49.2	52.8	56.5
41	22.4	24.9	27.5	30.2	33.1	36.0	39.1	42.4	45.7	49.2	52.8	56.6
42	22 5	24.9	27.5	30.3	33.1	36.1	39.2	42.4	45.8	49.3	52.9	56.6
43	22 5	25.0	27.6	30.3	33.2	36.1	39.2	42.5	45.9	49.3	53.0	56 7
44	22 6	25.0	27.6	30.4	33.3	36.2	39.3	42 5	45.9	49.4	53.0	56.8
45	22.6	25.1	27.7	30.4	33.3	36.2	39.4	42.6	46.0	49.5	53.1	56.8
46	22.6	25.1	27.7	30.4	33.3	36.3	39 4	42.6	46 0	49.5	53.2	56.9
47	22.7	25.2	27.8	30.5	33.3	36.3	39.5	42.7	46.1	49.6	53.2	57.0
48	22.7	25.2	27.8	30.5	33 4	36.4	39.5	42.7	46.1	49.6	53.3	57.0
49	22.8	25.	27.8	30.6	33.4	36.4	39.6	42.8	46.2	49.7	53.3	57.1
50	22.8	25.	27.9	30.6	33.5	36.5	39.6	42.9	46.3	49.8	53.4	57.1
51	22.9	25.3	27.9	30.7	33.5	36.6	39.7	42.9	46.3	49.8	53.5	57.2
52	22.9	25.4	28.0	30.8	33.6	36.6	39.8	43.0	46.4	49.9	53.5	57.2
53	22.9	25.4	28.0	30.8	33.6	36.7	39.8	43.0	46.4	49.9	53.6	57.3
54	23.0	25.5	28.1	30.9	33.7	36.7	39.8	43.1	46.5	50 0	53.6	57.4
55	23.0	25.5	28.1	30.9	33.7	36.8	39.9	43.2	46.5	50 1	53.7	57.5
56	23.1	25.5	28.2	31.0	33.8	26.8	40.0	43.2	46.6	50.1	53.8	57.5
57	23.1	25.6	28.2	31.0	33.8	26.9	40.1	43.3	46.7	50.2	53.8	57 6
58	23.1	25.6	28.3	31.1	33.9	36.9	40.1	43.3	46.7	50.2	53.9	57.6
59	23.2	25.7	28.3	31.1	33.9	37.0	40.2	43.4	46.8	50 3	54.0	57.7
60	23.2	25.7	28.3	31.1	34.0	37.0	40.2	43.4	46.8	50.4	54.0	57.8

Table II.

General Table of the Reduction to the Meridian. Part I. Argument. Hour Angle in Time.

Sec.	0′	1′	2′	3′	4′	5′	6′	7′	8′	9′	10′	11′	12′	18′	14′	15′
0	0″0	2″0	7″8	17″7	31″4	49″1	70″7	96″2	125″7	159″0	196″3	237″5	280″7	331″8	384″7	441″6
1	0.0	2.0	8.0	17.9	31.7	49.4	71.1	96.9	126.2	159.6	197.0	238.3	283.5	332.6	385.6	442.6
2	0.0	2.1	8.1	18.1	31.9	49.7	71.5	97.1	126.7	160.2	197.6	239.0	284.2	333.4	386.5	443.6
3	0.0	2.2	8.2	18.3	32.2	50.1	71.9	97.6	127.2	160.8	198.3	239.7	285.0	334.3	387.5	444.6
4	0.0	2.2	8.4	18.5	32.5	50.4	72.3	98.1	127.8	161.4	198.9	240.4	285.8	335.3	388.4	445.6
5	0.0	2.3	8.5	18.7	32.7	50.7	72.7	98.5	128.3	162.0	199.6	241.2	286.6	336.0	389.3	446.5
6	0.0	2.4	8.7	18.9	33.0	51.1	73.1	99.0	128.8	162.6	200.3	241.9	287.4	336.9	390.2	447.5
7	0.0	2.4	8.8	19.1	33.3	51.4	73.5	99.4	129.4	163.2	200.9	242.6	288.2	337.7	391.1	448.5
8	0.0	2.5	8.9	19.3	33.5	51.7	73.9	99.9	129.9	163.8	201.6	243.3	289.0	338.6	392.1	449.5
9	0.0	2.6	9.1	19.5	33.8	52.1	74.3	100.4	130.4	164.4	202.2	244.1	289.8	339.4	393.0	450.5
10	0.1	2.7	9.2	19.7	34.1	52.4	74.7	100.8	131.0	165.0	202.9	244.8	290.6	340.3	393.9	451.5
11	0.1	2.7	9.4	19.9	34.4	52.7	75.1	101.3	131.5	165.6	203.6	245.5	291.4	341.2	394.8	452.5
12	0.1	2.8	9.5	20.1	34.6	53.1	75.5	101.8	132.0	166.2	204.2	246.2	292.2	342.0	395.8	453.5
13	0.1	2.9	9.6	20.3	34.9	53.4	75.9	102.3	132.6	166.8	204.9	247.0	293.0	342.9	396.7	454.5
14	0.1	3.0	9.8	20.5	35.2	53.8	76.3	102.7	133.1	167.4	205.6	247.7	293.8	343.7	397.6	455.5
15	0.1	3.1	9.9	20.7	35.5	54.1	76.7	103.2	133.6	168.0	206.3	248.5	294.6	344.6	398.6	456.5
16	0.1	3.1	10.1	20.9	35.7	54.5	77.1	103.7	134.2	168.6	206.9	249.2	295.4	345.5	399.5	457.5
17	0.2	3.2	10.2	21.2	36.0	54.8	77.5	104.2	134.7	169.2	207.6	249.9	296.2	346.3	400.5	458.5
18	0.2	3.3	10.4	21.4	36.3	55.1	77.9	104.6	135.3	169.8	208.3	250.7	297.0	347.2	401.4	459.5
19	0.2	3.4	10.5	21.6	36.6	55.5	78.3	105.1	135.8	170.4	208.9	251.4	297.8	348.1	402.3	460.5
20	0.2	3.5	10.7	21.8	36.9	55.8	78.8	105.6	136.4	171.0	209.6	252.2	298.6	349.0	403.3	461.5
21	0.3	3.6	10.8	22.0	37.2	56.2	79.2	106.1	136.9	171.6	210.3	252.9	299.4	349.8	404.2	462.5
22	0.3	3.7	11.0	22.3	37.4	56.5	79.6	106.6	137.4	172.2	211.0	253.6	300.2	350.7	405.1	463.5
23	0.3	3.8	11.1	22.5	37.7	56.9	80.0	107.0	138.0	172.9	211.6	254.4	301.0	351.6	406.1	464.5
24	0.3	3.8	11.3	22.7	38.0	57.3	80.4	107.5	138.5	173.5	212.3	255.1	301.8	352.5	407.0	465.5
25	0.3	3.9	11.5	22.9	38.3	57.6	80.8	108.0	139.1	174.1	213.0	255.9	302.6	353.3	408.0	466.5
26	0.4	4.0	11.6	23.1	38.6	58.0	81.3	108.5	139.6	174.7	213.7	256.6	303.5	354.2	408.9	467.5
27	0.4	4.1	11.8	23.4	38.9	58.3	81.7	109.0	140.2	175.3	214.4	257.4	304.3	355.1	409.9	468.5
28	0.4	4.2	11.9	23.6	39.2	58.7	82.1	109.5	140.7	175.9	215.1	258.1	305.1	356.0	410.8	469.5
29	0.5	4.3	12.1	23.8	39.5	59.0	82.5	110.0	141.3	176.6	215.8	258.9	305.9	356.9	411.7	470.5
30	0.5	4.4	12.3	24.0	39.8	59.4	83.0	110.4	141.8	177.2	216.4	259.6	306.7	357.7	412.7	471.5
31	0.5	4.5	12.4	24.3	40.1	59.8	83.4	110.9	142.4	177.8	217.1	260.4	307.5	358.6	413.6	472.6
32	0.6	4.6	12.6	24.5	40.3	60.1	83.8	111.4	143.0	178.4	217.8	261.1	308.4	359.5	414.6	473.6
33	0.6	4.7	12.8	24.7	40.6	60.5	84.2	111.9	143.5	179.0	218.5	261.9	309.2	360.5	415.6	474.6
34	0.6	4.8	12.9	25.0	40.9	60.8	84.7	112.4	144.1	179.7	219.2	262.6	310.0	361.1	416.6	475.6
35	0.7	4.9	13.1	25.2	41.2	61.2	85.1	112.9	144.6	180.3	219.9	263.4	310.8	362.2	417.5	476.6
36	0.7	5.0	13.3	25.4	41.5	61.6	85.5	113.4	145.2	180.9	220.6	264.1	311.6	363.1	418.4	477.6
37	0.7	5.1	13.4	25.7	41.8	61.9	86.0	113.9	145.8	181.6	221.3	264.9	312.5	363.9	419.4	478.7
38	0.8	5.2	13.6	25.9	42.1	62.3	86.4	114.4	146.3	182.2	222.0	265.7	313.3	364.6	420.3	479.7
39	0.8	5.3	13.8	26.2	42.5	62.7	86.8	114.9	146.9	182.8	222.7	266.4	314.2	365.7	421.3	480.7
40	0.9	5.4	14.0	26.4	42.8	63.0	87.3	115.4	147.5	183.4	223.4	267.2	315.0	366.6	422.2	481.7
41	0.9	5.6	14.1	26.6	43.1	63.4	87.7	115.9	148.0	184.1	224.1	267.9	315.8	367.5	423.2	482.8
42	1.0	5.7	14.3	26.9	43.4	63.8	88.1	116.4	148.6	184.7	224.8	268.7	316.6	368.4	424.2	483.8
43	1.0	5.8	14.5	27.1	43.7	64.2	88.6	116.9	149.2	185.4	225.5	269.5	317.4	369.3	425.1	484.8
44	1.1	5.9	14.7	27.4	44.0	64.5	89.0	117.4	149.7	186.0	226.2	270.2	318.3	370.2	426.1	485.8
45	1.1	6.0	14.8	27.6	44.3	64.9	89.5	117.9	150.3	186.6	226.9	271.0	319.1	371.1	427.0	486.9
46	1.2	6.1	15.0	27.9	44.6	65.3	89.9	118.4	150.9	187.3	227.6	271.8	319.9	372.0	428.0	487.9
47	1.2	6.2	15.2	28.1	44.9	65.7	90.3	118.9	151.5	187.9	228.3	272.6	320.8	372.9	429.0	488.9
48	1.3	6.4	15.4	28.3	45.2	66.0	90.8	119.5	152.0	188.5	229.0	273.3	321.6	373.8	430.0	490.9
49	1.3	6.5	15.6	28.6	45.5	66.4	91.2	120.0	152.6	189.2	229.7	274.1	322.4	374.7	430.9	491.0
50	1.4	6.6	15.8	28.8	45.9	66.8	91.7	120.5	153.2	189.8	230.4	274.9	323.3	375.6	431.9	492.0
51	1.4	6.7	15.9	29.1	46.2	67.2	92.1	121.0	153.8	190.5	231.1	275.6	324.1	376.5	432.8	493.1
52	1.5	6.8	16.1	29.4	46.5	67.6	92.6	121.5	154.4	191.1	231.8	276.4	325.0	377.4	433.8	494.1
53	1.5	7.0	16.3	29.6	46.8	68.0	93.0	122.0	154.9	191.8	232.5	277.2	325.8	378.3	434.8	495.2
54	1.6	7.1	16.5	29.9	47.1	68.3	93.5	122.5	155.5	192.4	233.8	278.0	326.7	379.2	435.7	496.2
55	1.6	7.2	16.7	30.1	47.5	68.7	93.9	123.1	156.1	193.1	234.0	278.9	327.5	380.2	436.7	497.2
56	1.7	7.3	16.9	30.4	47.8	69.1	94.4	123.6	156.7	193.7	234.7	279.5	328.4	381.1	437.7	498.2
57	1.8	7.5	17.1	30.6	48.1	69.5	94.8	124.1	157.3	194.4	235.4	280.3	329.2	382.0	438.7	499.2
58	1.8	7.6	17.3	30.9	48.4	69.9	95.3	124.6	157.8	195.0	236.1	281.1	330.0	382.9	439.6	500.3
59	1.9	7.7	17.5	31.1	48.8	70.3	95.7	125.1	158.4	195.7	236.8	281.9	330.9	383.8	440.6	501.4

The Numbers in this Table are additive for the inferior Observations of Circumpolar Stars.

TABLE III.

The Numbers in this Table are always additive.

General Table. Part II. Argument. Hour Angle.								
M. S.	S.	Diff.	M. S.	S.	Diff.	M. S.	S.	Diff.
0 0	0.000		8 10	0.041	4	12 10	0.205	12
1 0	0.000		20	0.045	4	20	0.217	12
2 0	0.000		30	0.049	4	30	0.229	12
3 0	0.001		40	0.053	4	40	0.241	13
4 0	0.002		50	0.057	4	50	0.254	13
5 0	0.006		9 0	0.061	5	13 0	0.267	14
10	0.007		10	0.066	5	10	0.281	14
20	0.008		20	0.071	5	20	0.295	15
30	0.009		30	0.076	5	30	0.310	16
40	0.010		40	0.081	6	40	0.326	16
50	0.011		50	0.087	6	50	0.342	17
6 0	0.012		10 0	0.093	7	14 0	0.359	17
10	0.013		10	0.100	7	10	0.376	18
20	0.014		20	0.107	7	20	0.394	19
30	0.016		30	0.114	7	30	0.413	19
40	0.018		40	0.121	8	40	0.432	20
50	0.020		50	0.129	8	50	0.452	21
7 0	0.022		11 0	0.137	8	15 0	0.473	21
10	0.024		10	0.145	9	10	0.494	22
20	0.026		20	0.154	9	20	0.516	23
30	0.029		30	0.163	10	30	0.539	24
40	0.032		40	0.173	10	40	0.563	24
50	0.035		50	0.183	11	50	0.587	25
8 0	0.038		12 0	0.194		16 0	0.612	

SECT. IV. *On the Use of the Repeating Circle as a Meridian Circle, when its repeating Property is dispensed with, but the Errors of Division equally done away.*

New method of using the repeating circle.

As the French astronomers have never used this instrument but in the manner above mentioned, it is not perhaps generally known, that it may be employed as a meridian instrument to determine the declinations of stars, without recurring to its property of repeating; and we are permitted, on the authority of the astronomer royal, to state it as his opinion, that, when so employed, it is the most perfect portable instrument of its size hitherto constructed. When placed in the plane of the meridian, and there suffered to remain till a series of observations on many stars is completed, it will very nearly resemble, in its mode of action, the mural circle lately erected by Mr Troughton at Greenwich. Indeed, the only difference will be, that not being secured on a wall, the level must be examined at each observation; whereas it appears, by a paper in the volume of the *Philosophical Transactions* for 1813, that the Greenwich instrument is so securely fixed, as to need neither level nor plumbline. It ought also to be remarked, that the small instrument has an advantage, which the mural circle does not possess, of having its divided surface turned either to the east or west, so as to give either zenith distances or polar distances in the manner which we shall now describe.

To illustrate the method which we propose to recommend, we shall take such a case as is most likely to occur to an ingenious astronomer who may possess such an instrument, and be inclined to avail himself of the powers it possesses. We shall suppose his object is to determine the north polar distance, or declination of a certain number of stars, if the result is intended to be of public utility; but few stars should be chosen, and those should be selected, whose places there is reason to suppose may not be accurately known; or the observer may attempt a series of circumpolar stars, with a view to determine the quantity of refraction best adapted to his own observatory. Perhaps it may admit of doubt, whether so small an instrument can be sufficiently accurate for so nice a purpose; but the method of observation is in each case the same. First, If zenith distances be required, (the co.latitude of the place being supposed known by previous observations of the pole star taken by repetition,) the method of proceeding is as follows: Clamp the back telescope firmly in any position, and observe a series of stars one night with the face of the instrument towards the east, observe the same series the next night with the face of the instrument towards the west, repeat this operation alternately, till a considerable number of observations are obtained, the means of the opposite readings will be the required zenith distances subject to the error of division; and as each star will have been observed on eight different arcs, this error will certainly be extremely small. To reduce it, however, to within still narrower limits, let the level be again moved to some new position, and another series be observed, the mean of the two will now approach nearer the truth, and this process of continually changing the telescope with its level should be persevered in, till satisfactory results are obtained. The principal error to be apprehended, is from the alteration which the bubble of the level may be liable to from change of temperature. Perhaps a judicious adaptation of a plumbline might for this reason be a great improvement to this instrument. If the pole star be observed both below and above the pole in every series, then the position of the polar point may be found, and the north polar distances will in that case be obtained by direct measurement from the pole. The reversion of the instrument, if this method be adopted, will have no other effect than to bring a new set of divisions into the series, and will be equivalent to a change of position of the level, and rather inferior in point of convenience. An intelligent astronomer will choose between these methods, and combine them according to circumstances, as it is almost impossible in practical astronomy to devise any general rule, that will not in many cases admit of considerable modification. Both these methods suppose, that the observer derives his results from his own observations alone; but we conceive that, for instruments of small dimensions, it would practically be much more advisable for an observer, to avail himself of the Catalogue of Stars given in the following page. Indeed, one of the principal intentions of this catalogue, is to afford to astronomers a certain number of standard stars, to enable them to determine the polar distances of other stars by comparison, in the same manner as Dr Maskelyne's Catalogue of the Right Ascensions is universally taken as a standard of comparison, when the right ascension of other celestial objects is required. We avail ourselves of this early opportunity of giving this catalogue to our readers. It is deduced from nearly two thousand observations, made with the most accurate instrument hitherto constructed.

If this method be adopted, the instrument should at first be so placed, as to mark nearly zero when the telescope points to the pole, a certain number of the Greenwich stars should be observed in each series, and from these standard stars the position of the instrument should be deduced, or, in other words, the error of collimation should be found.

With an instrument of such moderate dimensions, it may reasonably be expected, that different stars will give different results, therefore as many of these standard stars as possible should be observed every night, and the mean difference of the observed and computed place should be taken as the error of collimation, to be applied to the observations of the other stars, whose north polar distances it is the object of the observer to obtain. It is almost unnecessary to add, that if the sun, moon, or planets, make part of a series of observations, the same error of collimation is to be applied to them.

Having finished one series of results in the above position of the telescope, or rather level, it should be unclamped and changed to a new position, for instance, so as to mark 10° when the telescope points to the pole. In every observation now, the instrument will mark 10° more than the polar distance of the star, besides a new error of collimation, which is to be investigated by a comparison with the Greenwich Catalogue, the same as before.

By comparing these results with those obtained in the first position, the observer will be able to form some opinion of the degree of confidence to which his observations are entitled. He may now change the position of his instrument another 10°, and so proceed till he is satisfied of the accuracy of his catalogue. We are fully convinced, that, with the exception of Polaris and β Ursæ Minoris, a much more accurate catalogue may be made by this method than by the operation of repeating, which in fact does not appear to have ever been very successfully employed for stars south of the zenith, even by the French astronomers, notwithstanding their partiality to this instrument. The French instruments being very indifferently divided, the above method of observation would not suggest itself, because the error of a single observation would probably be very considerable; but in instruments of Mr Troughton's construction, it would rarely occur that the error of division would amount to 5″, the error of observation, bisection, level, &c. &c. must be common to every method that can be devised.

We shall now conclude this article with Mr Pond's Catalogue, referred to in the preceding page.

Mr Pond's Catalogue of the North Polar Distances of 44 of the principal Fixed Stars, deduced from 1452 Observations.

No.	Names of the Stars.		North Polar Distances beginning 1813.	Number of Observations.	Maximum of Error to which this Catalogue may probably be liable.
			° ′ ″		
1		Polaris { Summer Winter	1 41 22,07 1 41 21,47	120	″
2	β	Ursæ Minoris	15 4 48,95	50	0,50
3	β	Cephei	20 5 30,30	20	0,50
4	α	Ursæ Majoris	27 14 31,50	36	0,50
5	α	Cephei	28 12 12,35	20	0,50
6	α	Cassiopeiæ	34 29 22,83	38	0 50
7	γ	Ursæ Majoris	35 15 55,10	10	0,75
8	γ	Draconis	38 29 3,73	68	0,25
9	η	Ursæ Majoris	39 44 57,80	50	0,25
10	α	Persei	40 48 52,37	26	0,50
11		Capella	44 12 20,96	37	0.50
12	α	Cygni	45 22 57,19	40	0,50
13	α	Lyræ	51 23 0,72	70	0,25
14		Castor	57 42 46,57	30	0,50
15		Pollux	61 31 56,57	31	0,50
16	β	Tauri	61 33 43,51	23	0,50
17	α	Andromedæ	61 56 29,61	35	0.50
18	α	Cor. Borealis	62 38 55.70	53	0,50
19	α	Arietis	67 25 36.76	44	
20		Arcturus	69 50 19,04	50	0.25
21		Aldebaran	73 52 35,18	30	0,50
22	β	Leonis	74 22 57,24	24	0 50
23	α	Herculis	75 23 13,97	23	0,59
24	α	Pegasi	75 47 51,77	20	0,50
25	γ		75 51 21,00	25	0,50
26		Regulus	77 7 22,94	30	0.50
27	α	Ophiuchi	77 17 39.66	37	
28	γ	Aquilæ	79 50 0,62	38	0,75
29	α		81 36 58,88	45	
30	β		84 3 4,09	12	1,0*
31	α	Orionis	82 38 16,11	21	0,50
32	α	Serpentis	82 58 39,50	33	0,50
33		Procyon	84 18 15,03	20	0,50

No.	Names of the Stars.	North Polar Distances beginning 1813.	Number of Observations.	Maximum of Error to which this Catalogue may probably be liable.
34	α Ceti	86 39 0,75	18	1,0*
35	α Aquarii	91 13 21,64	20	0,50
36	α Hydræ	97 51 11,30	10	0,75
37	Rigel	98 25 32,85	30	1,0*
38	Spica Virginis	100 10 51,30	20	1,0
39	1 α Capricorni	103 4 35,45	35	
40	2	103 6 52,32	28	
41	1 α Libræ	105 12 39,26	10	
42	2	105 15 22,69	15	
43	Sirius	106 28 0,70	34	
44	Antares	116 0 16,63	36	

The stars α Aquilæ, α Arietis, and α Ophiuchi, are probably determined within a second of the truth; but Mr Pond met with some discordances in these stars which he does not comprehend. Future observations will shew, whether these are accidental, or arise from some periodical cause.

Those stars marked * were determined with the quadrant, its error having been ascertained by comparison with the circle, by other stars having nearly the same declination.

In the fourth column, Mr Pond has annexed the degree of uncertainty, or maximum of error, to which he conceives the results to be liable. These numbers not being derived from any strict mathematical process, must only be considered as indicating the opinion he has formed on the subject. When the observations themselves are published, we shall have an opportunity of stating at length the grounds of this opinion.

We are sorry that it is not in our power at present to communicate to our readers a complete account of Mr Pond's new method of determining the position of an instrument by means of the preceding Catalogue of Stars; but as that distinguished astronomer is at present engaged in drawing up a paper on this subject for the Royal Society, we shall be able to give a full account of it in another part of our work. It completely supersedes every other method, and renders the cumbersome apparatus of levels and plumblines completely unnecessary in fixed observatories.

Circle, Circuits.

CIRCLE, among the many fanciful analogies, which have been drawn by the ancients and moderns from the circle, or from lines drawn in and about it, it may be right here to mention the application of it to *music*, by the late Mr Harrison, the time-piece maker, who adopted a scale of temperament, wherein the major third has the same ratio to the octave, as the diameter of a circle has to its circumference; in which case $\text{III} = 194.77767\,\Sigma + 4f + 17m$, in Mr Farey's notation, or $\text{III} - 2\tfrac{1}{9}\Sigma$ very nearly. See HARRISON's *Temperament* of the Musical Scale. (ε)

CIRCLE. See GEOMETRY.

CIRCUITS, in law, are the journeys or rounds made by the supreme judges twice a year, for distributing justice in the different counties of the kingdom. In England, the circuits take place in the respective vacations after Hilary and Trinity terms; and the counties of that part of the kingdom, are distributed into six districts or circuits, viz. 1st, The *Midland* circuit; containing the counties of Northampton, Rutland, Lincoln, Nottingham, Derby, Leicester, and Warwick.—2d, *Norfolk;* containing Bucks, Bedford, Huntingdon, Cambridge, Norfolk, and Suffolk.—3d, *Home*; Hertford, Essex, Kent, Sussex, and Surrey.—4th, *Oxford;* Berks, Oxford, Hereford, Salop, Gloucester, Monmouth, Stafford, and Worcester.—5th, *Western;* Southampton, Wilts, Dorset, Cornwall, Devon, and Somerset.—And 6th, The *Northern;* containing York, Durham, Northumberland, Cumberland, Westmoreland, and Lancashire. Wales is divided into two circuits, south and north.

Scotland is distributed into three circuits—the *Northern*, comprehending the counties of Inverness, Ross, Elgin, Caithness, Sutherland, Cromarty, Nairn, Aberdeen, Banff, Kinkardine, Perth, Forfar, Fife, and the stewartries of Orkney and Zetland;—the *Southern*, comprehending Roxburgh, Berwick, Selkirk, Peebles, Dumfries, Ayr, Wigton, and the stewarty of Kirkudbright;—and the *Western*, comprehending Stirling, Clackmannan, Kinross, Lanark, Dumbarton, Renfrew, Argyle, and Bute. The periods, at which the Scotch judges perform their journeys, are some time in the course of the spring and autumn vacations of the court of session. See ASSIZES.

Circular ‖ Circumcision.

CIRCULAR PARTS. See TRIGONOMETRY.

CIRCULATION OF THE BLOOD. See ANATOMY, vol. i. p. 807, vol. ii. p. 18, and PHYSIOLOGY.

CIRCUMCISION, denotes the practice of cutting off the *preputium* or foreskin of the penis.

This practice was adopted universally among the Jews, and was also introduced partially, if not universally, among some other nations. The sacred scriptures carry the antiquity of this practice much farther back than any other writings. It is first mentioned in the 17th chap. of Genesis, and is stated as the sign or symbol of the covenant which God made with Abraham. *This is my covenant which ye shall keep between me and you, and thy seed after thee; every man-child among you shall be circumcised. And ye shall circumcise the flesh of your foreskin; and it shall be a token of the covenant betwixt me and you; and he that is eight days old shall be circumcised.*

Among the later Jews the ceremony was performed with much solemnity, in the synagogue, on the eighth day, as God had appointed. Two seats with silk cushions were placed, the one for the god-father, who was to hold the child, the other for Elias, who was supposed to be present at the ceremony. The child was brought to the door of the synagogue by the god-mother accompanied with other females, none of whom were permitted to enter. The godfather then seating himself in the chair which had been provided for him, held the child whilst the operator cut off the foreskin with a knife, a razor, or a sharp stone: a little styptic powder was applied to stop the bleeding, and the ceremony concluded with prayers and hymns.

It is not thought necessary to say more respecting the object of circumcision, as it is plainly stated in scripture to be a token of the covenant between God and the family of Abraham: and the propriety of the token may be inferred from this, that they who bore such an indelible mark of their affiliation to God, would be continually reminded of their allegiance, and excited to preserve inviolate that solemn covenant, whose external sign they never could disavow. But Jewish writers have endeavoured to extract several mystical meanings from the rite of circumcision, besides its avowed and obvious use, as the visible sign of a covenant. Philo says, that it represented the necessity of retrenching sensual enjoyments, and of keeping in proper subjection all those lusts, and passions, which war against the soul. This idea is countenanced by the scriptures; "The Lord thy God," says Moses, "*will circumcise thy heart* and the heart of thy seed to love the Lord thy God." "The house of Israel," says Jeremiah, "is *uncircumcised in heart*." Some authors have even maintained, that circumcision was not merely calculated to convey this typical, or figurative meaning, but had a physical influence in producing continence and purity.

As one great end of circumcision was to distinguish the Israelites from the surrounding heathen nations, they seem to have thought it allowable to omit the ceremony, when there was no danger of being confounded with their idolatrous neighbours. Hence they neglected circumcision during the time of their sojourning in the wilderness: after they had passed Jordan, Joshua circumcised all the survivors of those who had been born in the wilderness. Moses also neglected to circumcise his son in the land of Midian, which gave rise to a curious incident when he was returning with his wife and family, into Egypt. It is said that the angel of the Lord met him and sought to kill him. "*Then Zipporah took a sharp stone, and cut off the foreskin of her son, and cast it at his feet, and said, surely a bloody husband thou art to me: So he let him go; then she said, a bloody husband thou art because of the circumcision,*" Exod. iv. 25, 26. We quote this passage because it seems to be little understood, and also because it seems to point out a peculiarity attending the rite of circumcision. It is generally supposed that the words of Zipporah are addressed to her husband, by way of reproach; and that she speaks contemptuously of the circumcision. There is no ground for this opinion, but the mistranslation in our version. Zipporah, as being a Midianitess, and of course a descendant of Abraham by Keturah, could not be unacquainted with circumcision, which was observed by all the descendants of the patriarch: and the readiness with which she performed the operation, is a proof that she was no stranger to the practice. The whole difficulty has arisen from translating the word *chatan, a husband,* which never in Scripture has that signification, but means a father-in-law or a son-in-law, or a bridegroom in *the day of his espousals.* Hence the learned Joseph Mede supposes the words of Zipporah to be certain *verba solemnia* addressed to her child, intimating that she had espoused him unto God, by a covenant of blood: and this opinion is confirmed by the words of Aben Ezra on this place; *Mos mulierum vocare filium cum circumcisus est* חתן (*chatan*). See Mede's *Works, Castell. Lexic. Heptaglot.* and *Parkhurst*, who supposes the words addressed to the angel with the same figurative meaning.

It is now necessary to attend to the history of circumcision in different nations; for we find this singular rite observed, not only by the Jews, but by the Egyptians, the Ethiopians, the Arabians, the Phenicians, the Colchians; and we find it existing at this day among many people, whose connection cannot now be traced with any of these nations. Herodotus in his *Euterpe* wishes to ascribe the origin of this practice, as the Greeks did of every thing that bore the marks of great antiquity, to the Egyptians. His words are, Μουνοι παντων Κολχοι και Αιγυπτιοι, &c. "The Colchians and Egyptians are the only people who have practised circumcision from the remotest antiquity: for the Phenicians and Syrians in Palestine, (the Jews) confess that they borrowed this practice from the Egyptians. These are the only people who circumcise, and they seem in this to imitate the Egyptians: but I am not sure whether the Egyptians communicated this practice to the Ethiopians, or the Ethiopians to the Egyptians."

There is considerable confusion, as well as misrepresentation, in this passage: in the outset the historian ascribes the origin of the practice to the Colchians and Egyptians, but concludes with saying that he was not sure but the Egyptians might have learned it from the Ethiopians. The account of his testimony, respecting the origin of circumcision, is evidently this, that he knew nothing at all about the matter. His attestation, however, to the existence of the practice among the people whom he has specified, is entitled to attention, the more so, as it has misled several authors, and induced them to ascribe the origin of circumcision to the Egyptians. This opinion was adopted by Celsus and Julian among the ancients; and has been favoured among the moderns by Sir John Marsham, Spencer, and Le Clerc.

In the first place, Origen tells us expressly, that the practice was not general among the Egyptians, but was observed only by their geometricians, astronomers, and diviners. This affords a strong presumption that they borrowed the practice from Moses, whose power, as a worker of miracles, they had so often felt and confessed. The mathematicians, and men of science among the Egyptians, were all jugglers, and pretenders to miracles, and prophecy; and as they alone practised circumcision, what can be more natural than to suppose, that they adopted it in imitation of Moses, whom they could not but regard as an *Archimagus*, or master in the art which they professed.

But farther, the Scriptures afford strong reasons for believing that circumcision, at an early period, was little if at all known among the Egyptians. When Pharaoh's daughter saw Moses, she said, *this is one of the Hebrew children*, and it is thought that she discovered this, by the distinctive mark of circumcision, which immediately ascertained his origin, as the rite was then not practised among the Egyptians. In the days of Ezekiel, it is evident that Egypt was ranked with the uncircumcised nations, for it is said that it should lie *uncircumcised*, slain with the sword, along with Ashur, Elam, Meshech, and Tubal, chap. xxxii. It is very evident then, that circumcision was never generally practised among the Egyptians; that it was adopted at an early period by particular classes among them is not denied: but we have not the shadow of evidence that its antiquity among them approaches any thing near to the time of Abraham. The residence of a circumcised people among the Egyptians for four hundred years, may easily account for the origin of the practice; especially as the person who first introduced them into the country, was celebrated for his wisdom, as well as his power; and he who led them out of Egypt, became formidable by the tremendous miracles which he performed.

Let us then compare Herodotus with Moses, (and we shall claim for the latter only the privilege of an ordinary historian), and see whose account is most entitled to credit. Herodotus conjectures that circumcision had its origin among the Egyptians; Moses, who wrote about 1000 years before him, affirms that it originated with Abraham by the express command of God. Nobody can doubt that circumcision was practised by the Israelites at the time when Moses wrote, otherwise he never could have referred to it as an ancient practice: and would it not have been a most glaring absurdity, to state it as a distinction, as a token of God's covenant with the seed of Abraham, and as a mark of his peculiar people, had it been at that time generally practised among the Egyptians? In short, we have every evidence which the nature of the subject can afford, or which any reasonable person could demand, that the Israelites did not borrow circumcision from the Egyptians. Shall we affirm, then, that the Egyptians received it from the Israelites? We have stated reasons which seem to render this probable: but we think it still more probable, that they received it from some of the other descendants of Abraham. In this view of the subject, there is much probability in the conjecture of Herodotus, that the Egyptians might borrow the practice from the Ethiopians, meaning thereby the Arabians, for it is certain that Arabia is often called Ethiopia by the ancients; and the confusion was still more increased by this circumstance, that the Ethiopians of Africa, in all probability, came from Arabia, so that writers were induced to give the same names to countries which they found possessed by the same people.

Now, there is no doubt whatever that all the Arabians were circumcised, and that too, long anterior to the time of Moses: and the reason is obvious; they were the lineal descendants of Ishmael the son of Abraham, and, like the founder of their nation, were circumcised, not on the eighth day, but in the thirteenth year of their age; that being the age of Ishmael when God commanded Abraham to circumcise his family. Here, then, we have brought the Egyptians fairly within the contagion of the practice. And if it should be suspected, that they would not willingly borrow this custom from nations inferior to themselves in point of antiquity and refinement, we are not without grounds for supposing that it was imposed by force. Josephus, *contra Apion.* quotes a long passage from Manetho, an Egyptian author, who says, that a great part of Egypt was overrun by a race from Arabia whom he calls *royal shepherds,* and that they held the country in subjection for many years. If these conquerors were Arabians, then they were Ishmaelites who circumcised, and, like all sects, would probably have a desire to proselytize.

We would not venture to pronounce which of the circumstances we have mentioned, introduced the partial use of circumcision among the Egyptians; for it never appears to have been general; probably they might all conspire in producing this effect. We have shewn, however, from the most authentic documents, that circumcision was practised by the descendants of Abraham, at a time when the history of Egypt and of Greece was lost in fable. We have shewn also, that the Egyptians were frequently brought in contact with these people, and various reasons, besides those which have been mentioned, might be assigned for their adopting this practice.

But how shall we account for its introduction among other nations? From whom did the Phenicians receive it? If it ever was adopted by the Phenicians, properly so called, it may be easily accounted for by their vicinity to Palestine. But there is a strong probability that the Phenicians of Herodotus actually mean the Samaritans, their immediate neighbours, who were composed of the ten revolted tribes of Israel, and of course were all circumcised.

A long story is given, on the very questionable authority of Sanchoniatho, of circumcision being introduced into Phenicia by Ilus or Cronus. Sir John Marsham insists that this was no other than Noah, and that therefore circumcision must have been practised long before the time of Abraham; Shuckford maintains, with more probability, that this Ilus or Cronus, was Abraham himself, especially as it is said that this founder of the Phenician dynasty sacrificed his only son, and that this was the origin of human sacrifices among the Phenicians. But we should reckon it a waste of time to dwell on such a dubious argument. They who wish for farther information on this part of the subject may consult Shuckford's *Connect.* vol. 1. p. 326.

But circumcision was also practised by the Colchians; and it is not so easy to trace the manner of its introduction among this people. Grotius supposes, and the opinion is not improbable, that the Colchians, and some of the neighbouring nations, were part of the ten tribes who were carried captive by Shalmanezer. It is very evident that there was at that time a deficiency in the population of various parts of the Babylonian empire, and its monarchs swept away whole nations to supply the defect. The ten tribes never returned from their captivity, and evident traces of them are to be found at this day, in various places of that vast extent of territory, which was subject to the kings of Babylon: and this is a probable way of accounting for the existence of circumcision, among many modern nations, whose history is lost, and who exhibit no other marks of their origin. Grotius supports his opinion respecting the Colchians, and some of the neighbouring nations of Thrace, by quoting the Scholiast on Aristophanes; his words are, "*Colchi et eorum vicini ex decem sunt tribubus, quas transtulit Salmanasar. Inde et in Thraciam quidam venere. Scoliastes ad Aristophanes Acharnenses;* Οδομαντων εθνος Θρακικον, φασι δε αυτους Ιουδαιους ειναι. *Odomantum gens est Thracica: dicuntur autem esse Judæi.*"

We do not reckon it necessary to pursue this subject farther: the amount of our argument is this, that circumcision never was practised but by the descendants of Abraham, and those nations who learned it from them. It is universally practised at present by the Arabs, Moors, and Turks, who have derived it from the Saracens, the lineal descendants of Ishmael.

Some authors have endeavoured to assign physical reasons for the adoption of circumcision, such as cleanliness, convenience, &c. Were this argument admitted, it would destroy the notion of a positive appointment, and lead us to seek for the origin of the practice in causes common to many nations. But all the arguments which have been advanced in support of this opinion, appear equally futile and absurd. The practice was universally accounted disgraceful, especially by the Roman writers, and is the subject of many sarcasms; hence we have the *curtis Judæis*, and the *Judæus appella* of Horace, and the illiberal misrepresentation of Juvenal, in which he charges the Jews with want of common humanity, alleging it to be their practice.

Non monstrare vias, eadem nisi sacra colenti
Quæsitum ad fontem solos deducere verpos. Sat. 14. v. 104.

It is also evident that the operation was painful, and, in many cases, dangerous. The sons of Jacob employed it as a device to destroy the house of Shechem, by advising the young men to be circumcised, and then falling upon them before the wounds were healed, when they were unable to defend themselves. Tacitus's account of the origin of the practice, though imperfect, as was to be expected, is nevertheless correct so far as it goes. Speaking of the Jews, he says, " Genitalia circumcidere instituêre, *ut diversitate noscantur*." l. 5. *sub init.*

A very singular custom, however, is found to exist in modern times, in Egypt, Abyssinia, and several other countries, for which physical reasons are assigned, we mean the circumcision of females. The practice is different in different countries; those who wish to know the mode of performing the operation in Egypt, may find it detailed in Sonini's *Travels*, with a minuteness which we reckon improper for our work. A different mode is adopted in Abyssinia. Bruce calls it *exsection*, *quia fit exsectione clitoridis.* After Abyssinia was converted to Christianity, this practice was laid aside as a remnant of Paganism. It appears, however, that the men preferred the Pagan females who had undergone the operation, and serious apprehensions were entertained for the Christian faith. A representation was made to the court of Rome, and a skilful surgeon was sent into Abyssinia to examine into the merits of the case, and to report. In consequence of his representations, the Abyssinians were formally authorized to resume the practice, which continues among them to the present day. Our learned readers may see the reason of this practice in the following quotation from *Huet. not. in Origen.* " Circumcisio feminarum fit resectione clitoridis, quæ pars, in Australium præsertim mulieribus, ita excrescit, ut ferro sit coercenda. Ita tradunt medici insignes Paulus Ægineta, l. 5. c. 70. Aët. *tetrabib.* l. 4. *Serm.* p. 103. Quorum hic ita pergit: quapropter Egyptiis visum est, ut antequam exuberet pars illa corporis amputetur; tum præcipue cum virgines nubiles sint elocandæ. Porro hanc consuetudinem circumcidendarum mulierum hodieque retinere Egyptios, ferunt ii que regiones illas lustraverunt, ignemque ad compescendam hujus partis luxuriem adhibere scribit. Morem hunc servare feminas in Persia et Cophtas in Ethiopia, Christi licet nomen professas." (*g*)

CIRCUMFERENTOR is the name of a mathematical instrument for measuring angles by the magnetic needle. It is sometimes used in land-surveying, where an approximation to the truth only is required. It is now completely superseded by other instruments. See SURVEYING. (*w*)

CIRCUMVALLATION. See FORTIFICATION.

CIRCUS, an edifice in use among the Romans, for the exhibition of chariot races, and other games. The Circensian games appear to have been introduced at Rome from a very early period. They were probably borrowed from the Etruscans. They were established by Romulus almost in the beginning of his reign, and they continued to retain their popularity till the latest times of the empire. The circus at first was a wooden inclosure in which the spectators stood, a few seats only being placed for the persons of principal distinction. The most ancient permanent circus at Rome of which we have received any account, was that built by Tarquinius Priscus, in the valley Murcia, between the Aventine and the Palatine hills. This circus continued for a long time to be the only one in Rome. It obtained the name of the Circus Maximus, whether from its great superiority in size to those of a later date, from its being appropriated to the celebration of the greater games, or from its consecration to the great gods. It was enlarged by Julius Cæsar, and rebuilt and richly ornamented by Augustus. Tiberius, Caligula, Claudius, and Nero, all made additions to it. It was farther enlarged by Trajan. Constantine added to it some new porticos; and his son Constans ornamented it with the great obelisk at present at the Lateran. Dionysius of Halicarnassus states the dimensions of this circus, as it was left by Augustus, to have been, for the length 3½ stadia, the breadth 4 jugera, corresponding respectively to upwards of 3, and to about 1½ English furlongs. It could then contain about 150,000 persons. In consequence of the additions made to it previously to the time of the elder Pliny, it became capable of containing 260,000 spectators; and an inscription placed over the great gate subsequently to the alterations made upon it by Trajan, bore that that emperor had rendered it adequate to receiving the whole Roman people. Of this superb edifice there remain only some very indistinct traces, which are level with the ground. The remembrance of it, however, is still preserved by tradition; the site of the building, which is at present occupied by gardens, and the cemetery of the Jews, being distinguished at Rome by the appellation *Cerchi.*

The other circuses at Rome were numerous and considerable. The Flaminian circus was, according to Livy, founded by Flaminius, the unfortunate antagonist of Hannibal. This circus has been frequently noticed by ancient authors. Dion Cassius relates, that a chace of crocodiles was exhibited in it by Augustus, when 36 of these animals were killed. On the site of this building, there are now erected the church and convent of Santa Caterina de Funari, the two palaces of the dukes Mattei, with several other edifices. The only remains of this circus are ruins hid beneath the present pavement of the city, which is considerably raised in that part. Among these ruins, there still flows a considerable stream of water, which had been employed anciently for the supply of the circus.

A great part of what was the area of the Agonal circus is occupied by the modern Piazzi Navona. The houses situated at the northern extremity plainly follow, in their curved direction, the bend of the circular end of the ancient edifice.

One of the most remarkable of the Roman circuses was that which was begun by Caligula, and terminated by Nero. It appears to have been destroyed as early as the time of Constantine, since the former basilica of St Peter, founded by that prince, occupied the same situation as the present edifice, the right side of which rests upon the walls of the circus. The superb obelisk which at present ornaments St Peter's place belonged to that ancient edifice. From the exhibition given of the direction of the circus by Fontana, (*Il Tempo Vatic.* p. 245.) it seems to have been longer than the modern church, with the colonnade.

In some late excavations, there were discovered considerable remains of a circus, which, as it is supposed, was begun to be built by Nero in the gardens of his aunt Domitia, and was finished by Adrian. There were at the same time found several antique paintings.

A circus was built by Heliogabalus, on ground without the present Porta Maggiore. It was hence that the obelisk was taken, which is now erected in the interior garden of the Vatican.

There was a fine circus in the Sallustian gardens, which, it is said, might be filled with water for the exhibition of Naumachiæ.

There was also the circus of Flora, on the Quirinal, at which the exhibitions were given by the courtezans of Rome.

But of all the ancient Roman circuses, the one which preserves the most considerable traces of its ancient form, and by which, therefore, the modern inquirer might be best assisted in gaining some idea of these structures, is that which is situated beyond the Porta Capena, now Porta St Sebastiana, and of which the ruins have, by a uniform tradition, been designated as the remains of the circus of Caracalla.

In the plan of Rome by Panvinius, there are uncertain indications of some other circuses. There likewise still exist obscure traces of circuses in different parts of the world that had been anciently subject to the Roman empire;—at Tarragona, Merida, and Saguntum, now Murviedro, in Spain; at Nismes, at Milan, and Antioch. There remains also the ancient Hippodrome at Constantinople.

To maintain order in such a concourse of people as attended the exhibitions at the circuses, and to prevent any offence to the Roman pride, which was very jealous of any mixture of persons of different ranks, there were persons called designators, who were to assign to every one his place. With similar views, Tarquin divided his circus into 30 compartments, a number equal to that of the *curiæ* into which the people of Rome were at that time divided.

Though the circuses were primarily constructed for the exhibition of chariot races, they were used also occasionally for various other purposes. Indeed the Ludi circenses themselves, included several other exercises besides these. The magistrates also frequently held their assemblies in those edifices, and exercised those public functions, which, from the great multitudes of people attending, could not have been so well discharged in the temples and basilicas. Cicero informs us, that many harangues were pronounced in the Flaminian circus. Plutarch says, that Lucullus exhibited his triumph in this circus; and it was in the same place, that Augustus pronounced the funeral oration of Drusus. The Agnaninians having to assemble a general council, appointed it to be held in their circus, where they declared war against the Romans. The circuses were also a kind of public places, that were frequented by charlatans, diviners, and other people of that class. See Bianconi *Descrizione del Circo de Caracalla; Mosaique d'Italica.* (K)

CIRENCESTER, or CICESTER as it is pronounced, is a borough and market town of England, in the county of Gloucester: It is situated on the river Churn, on the borders of Wiltshire, at the meeting of the three Roman roads, Foss-way, Irmin-street, and the Icknield-way. The town consists of four principal streets, and seven of a smaller size, with several lanes, and occupies an area about two miles in circuit. A great part of the street which leads from Gloucester is a hollow way, where a small branch of the Churn passes, and again falls into its channel at the second bridge. The houses are chiefly built of stone, but the principal ones are generally detached from the rest. The parish church, which was built in the 15th century, is reckoned one of the finest edifices in the kingdom. The tower is 134 feet high, and has 12 bells. There were formerly other two towers, but they are both destroyed. It has five chapels of ease, of which St Mary's and St John's have stone roofs. The altar of St Mary's, which is not railed, has a stone pulpit, and is paved with black and white marble. The southern porch of St John's church, is a fine Gothic structure, and over the porch is the town hall. St Catherine's chapel, on the north side, is remarkable for the sculpture in the compartments of the roof; and in Trinity chapel, there are two monuments of marble in memory of Earl Bathurst, and his son the Lord Chancellor. The chief public institutions are three charity schools, and three hospitals. The principal manufactures of Cirencester, are one of curriers knives, another of fine cloth, and a small carpet manufactory, beside two breweries.

Cirencester was the *Corinium* of Ptolemy, and the *Durocornovium* of Antoninus. It had a castle in the time of the Romans, and the city was encircled with a wall and ditch. The castle was demolished in the reign of Henry III. A Roman mosaic pavement, and other ancient remains, have been found in the neighbourhood, and in 1723 a Roman building, supposed to be a hypocaust, was discovered. A piece of ground called the Querns, on the south-west of the town, is supposed to have been the site of a Roman theatre. The following is the state of the population for 1811:

Number of inhabited houses, ...	902
Number of families, ...	948
Families employed in trade, &c. . .	526
Males, ...	2030
Females, ...	2510
Total population, ...	4540

See Rudge's *Gloucestershire.* (*j*)

CIRKNITZ, LAKE OF, the *Lugea Palus* of Strabo, is a lake in Carniola, remarkable for several curious natural phenomena which it exhibits. It is situated about six miles from Laybach, and is surrounded on the north by rugged and frightful rocks. It is fully two leagues long from east to west, and one league in width from north to south. Its depth varies from 6 to 24 feet. There are three islands on the lake, the most considerable of which is called Vornek, which has sufficient surface for a village called Ottok, and a church. The other two islands are called the greater and the lesser Goritza. A tongue of land, called Dornoschek, stretches very far into the lake, and forms a peninsula which is separated from the isle of Vornek by a very narrow strait. Eight rivulets run into the lake, the largest of which are the Cirknitz and the Obiny. The former passes by a village of the same name, which is situated at half a league from its mouth. Without reckoning Cirknitz and Ottok, there are seven villages at a very short distance from the margin of the lake.

There is no exit for the waters of the lake, excepting by two openings at the level of the surface, called the greater and the lesser Karlouza, which are natural aqueducts formed out of the solid rock, and passing through the middle of the mountain to the opposite side of it, where they discharge the water at the grotto of St Cantianus. In addition to these two canals, there are no fewer than eighteen apertures at the bottom of the lake through which the waters often retire, and completely disappear.

When this singular phenomenon begins to take place, the waters first retire through the opening called *Kamine*, and disappear by degrees, till at the end of the fifth day the bottom of the lake appears around this opening. At the end of the next five days the bottom of the lake is seen around the opening called *Vodomo.* At the end of other five days, the pool *Reschetto* is evacuated; five days afterwards the *Koten* pool is emptied; and in five days more the *Levisde* is dried. In 25 days therefore the whole bed of the lake has become dry, the water having during that time been also carried off by the other thirteen apertures. The bottom of the lake is now cultivated, and sown.

Vegetation advances with extraordinary rapidity, and in the course of three months the peasants gather hay and millet.

It is generally about the end of four months that the waters begin to return. They rush through the different openings with great force, and in the space of about 24 hours, the lake is completely filled. Sometimes the lake has emptied itself thrice in one year; at other times years have elapsed without its having discharged its waters; but whenever the phenomenon does take place, the waters always return in less than four months. The phenomenon generally takes place about the end of June, or the beginning of July. In 1729, the waters were absorbed twice, once in summer, and a second time in winter.

A great variety of fish is found in this lake, such as pike, trout, tench, eels, carp, and perch. The pike sometimes weighs ten, twenty, and even forty pounds; and whenever the waters begin to retire, a bell is rung at Cirknitz, to give notice of the event to the neighbouring villages. Every thing is then prepared for fishing, and if the ebb happens in the night-time, the peasants fish even by candle light. Valvasor, in his description of Carniola, (*Die Ehre des Herzogthums Crain* &c. *durch*, W. Valvasor, 1689, 4 vols. folio,) informs us, that when the water is entirely run off into its subterraneous caverns, the peasants descend with lights into the cavity called *Ribescajama*, which is in a hard rock, three or four fathoms under ground, to a solid bottom, where the water is carried off through very small holes, as through a sieve; the fish being left behind in this natural net.

The fishing of the lake belongs to the six lordships of Hasberg, Steenberg, Auersperg, Lass, Schneeberg, and the convent of Sittich. Some pools are given to the fishermen for their trouble, and they sometimes sell their chance before they cast their nets. The lord of Steenberg once gave a fisherman 30 guilders for his chance in one pool, and the quantity of fish caught on this occasion amounted to fourteen cart loads.

The lake of Cirknitz stands higher than the country about Planina, which is on one side of it, and is a low valley with several cavities. The other side of the lake is surrounded with high mountains, so that the phenomenon of the lake might be explained on the principles of Hydrostatics. (*π*)

CIRTIPUR. See Nepaul.

CISSAMPELOS, a genus of plants of the class Diœcia, and order Monadelphia. See Botany, p. 339.

CISSUS, a genus of plants of the class Tetrandria, and order Monogynia. See Botany, p. 124.

CISTUS, a genus of plants of the class Polyandria, and order Monogynia. See Botany, p. 239.

CITHAREXYLUM, a genus of plants of the class Didynamia, and order Angiospermia. See Botany, p. 254.

CITRIC Acid. See Chemistry.

CITROSMA, a genus of plants of the class Diœcia, and order Icosandria. See Botany, p. 341.

CITRUS, a genus of plants of the class Polyadelphia, and order Icosandria. See Botany, p. 287.

CITY (*civitas*), is defined by Coke, and after him by Blackstone, a town incorporated, which is or has been the see of a bishop; and though the bishopric be dissolved, as at Westminster, yet still it remains a city. Some, however, have disputed the accuracy of this characteristic difference between cities and other towns, the word *city* having, according to them, obtained in this island only since the conquest, though bishops, and their sees, were certainly known long before. It may be remarked also, as a very strong, or rather decisive authority in favour of this opinion, that Ingulph, in his History of the Abbey of Croyland, has related, that at the great council assembled in 1072, to settle the claim of precedence between the two English archbishops, it was decreed that bishops' sees should be transferred *from towns to cities*; and to this circumstance William of Malmsbury also refers; *concessum est*, says he, *episcopis de villis transire in civitates*. Yet though, originally, there thus appears to have been no necessary connection between cities and the sees of bishops, certain it is that for a long time the appellation has been confined to such towns only as either now are, or have been at some former period, honoured with that ecclesiastical distinction.

For a very distinct and probable account of the progress of cities, towns, &c. in wealth and consequence, see the *Wealth of Nations*, book 3. cap. 3. and Robertson's *Charles* V. vol. 1. See also Madox's *Firma Burgi*. and Brady's *Historical Treatise of Cities and Burghs*. (J. B.)

CIVIDAD RODRIGO, or *Rodericopolis*, a fortified town in the kingdom of Leon in Spain, was built in the 13th century, on the scite of the ancient *Mirobriga*. It is situated on the river Agueda, in a flat and good country, which produces grain of all kinds, wine, oil, honey, and almonds.

Cividad Rodrigo is well fortified, and has seven gates. The castle, though of a common construction, is very strong, and the ditch which surrounds the walls has been dug anew. The wall around the town is weak, but its platform forms an agreeable promenade. The streets are tolerably regular, and the public buildings are numerous. There is one cathedral, one collegiate church, six parish churches, five convents of monks, four of nuns, one seminary, and two hospitals. The cathedral, which was built in the time of Ferdinand II. of Leon, is of freestone, but is not finished. The church is Gothic, as well as the two parts of the cloister, but the other two parts are modern. There are three gates to the chapel, which is adorned with Corinthian columns. The finest piece of architecture is the chapel of Cerralvo, founded in 1588. Its form is square, and the body of it is in the form of a cross; the exterior decorations are of the Doric order, and the interior of the Ionic, with pilasters and a dome. There is nothing remarkable in any of the other churches, except that of the Augustines, which is well built, and adorned with five orders of architecture. In the church of St Francis in the Fauxburg, there is a handsome chapel, containing the tomb of a bishop of Zamara. The seminary was begun in 1765, and finished in 1769. Another building, larger than the first, and of the Doric order, was afterwards added, in which there was a church with vaulted roofs and a cupola. The principal altar is of stucco, and is of the Composite order. On the Plaza-Mayor there are three Roman columns on a triangular plinth, with two inscriptions on the cornice. The old Roman aqueduct is destroyed, but another has been erected for supplying the town with water.

There is in this town an agricultural society, who attend to the cultivation of the land, to the discovery of mines and quarries, and even to the instruction of youth. About ¾ of a league from the town is the beautiful convent of Norberlins. The cloister is magnificent, and charmingly situated near the river. Cividad Rodrigo was once famous for its manufactures of tapestries, embroideries, laces, and leather; but these are now gone, and there is only a small tannery and a manufactory for hard soap. Some of the inhabitants employ themselves in searching for grains of gold in the sands of the Agueda. The population of the town is 10,000. See Britain, Vol. IV. p. 723, 739. (*w*)

CIVIL ARCHITECTURE.

THIS term is meant to comprehend whatever relates to edifices appropriated to the purposes of civil life. These purposes vary with the progress of society, but we apprehend the whole may, with propriety, be classed under the heads of religion, legislation, public exercises and amusements, domestic life, and commerce. For the sake of distinctness, we shall divide the subject into the following parts, viz.

1. History of Architecture.
2. Principles of Architecture.
3. Practice of Architecture.

PART I. HISTORY OF ARCHITECTURE.

Of the origin of architecture.

RESPECTING the origin and early progress of architecture, it is in vain to expect much distinct historical evidence. Being indispensible not only for the comfort but the protection of mankind, the art of building must have been practised, and brought to a considerable degree of perfection, before lasting edifices were constructed; and it is only by means of works of this description, that we derive the earliest information respecting the art itself, and the other early acquirements of men. All the previous steps must consequently be unknown to us; but from observing the conduct of men now in a rude state, and, from the earliest authentic records, tracing the progress of others to civilization, wealth, and power, we are enabled to form a tolerably distinct notion of the early progress of architecture.

Buildings for domestic purposes being, from motives of œconomy, of slight construction, are, without much trouble or expence, varied, to suit the changes continually taking place in society. It is therefore to public buildings that we must have recourse, in order to trace the features of the art in remote ages.

In Egypt, Persia, and Hindostan, there are architectural works of great magnificence, whose æra of construction is by no means satisfactorily determined by historians. It is also uncertain in which of those countries architecture was first brought to this degree of perfection. Two very eminent authors (Sir William Jones and Dr Robertson,) after much investigation, infer, from the great and united efforts necessary to accomplish the architectural works found in Hindostan, and from the early and complete separation of the classes of society, that the eastern quarter of the world has a preferable claim to Egypt; and they also conceive, that Iran, or Persia, furnished to both the other countries the rudiments of knowledge. Others assert, that Hindostan is wholly indebted to Egypt, that this connection was early established through the means of colonies, who sought refuge in India from the tyranny of the shepherd kings, and that, after the expedition of Cambyses, the temples and tombs in Persia were constructed by Egyptian workmen.

The strong resemblance which subsists between many of the leading features in the magnificent tombs, temples, and palaces, in upper Egypt, and those at Salsette, Elephanta, and Vellore, and other parts of India, and also some of the splendid remains at Persepolis, is convincing evidence, that there has very early been a communication of architectural knowledge in those countries.

Simplicity of the Egyptian style.

If we were to form a judgment from the style of the architecture and workmanship of the several countries, the great simplicity of the Egyptian certainly establishes a strong claim to originality, and its perfect sameness is a strong evidence of its having been executed under the controul of one unvarying and despotic power,—a power which left no latitude for the exertion of individual originality of genius, and which was itself restricted by modes too sacred to be departed from. A power of this description indicates a state, whose establishments had been of long duration, and whose wealth enabled it to appropriate a large portion of unproductive labour. But the direction of this could not have been in the hands of despotic sovereigns, whose operations are too capricious and unsteady: it must have been a permanent establishment, which had also great influence in the state; and this, during the prosperity of the Thebaid, was precisely the case with the Egyptian priesthood.

Indian and Egyptian styles compared.

The Bramins of India formed a similar establishment, and the tombs and temples of that country are also of great magnitude and splendour; but in the Hindostan edifices, although many parts of the general arrangement and principal features resemble those of Egypt, yet simplicity has been more departed from, and circular outlines similar to those of pagodas have been introduced. The most splendid of the Indian edifices being wholly formed by excavation, may, most properly, be denominated sculptures; but even for this mode abundance of originals exist in Egypt. The numerous sculptured tombs adjacent to the principal cities in the Thebaid, are perfect examples as far as regards excavations within the natural rock, and the gigantic colossal statues are equally so as to isolated forms.

Persian and Egyptian styles compared.

The ancient Persian architecture, with the exception of some tombs, is composed of erections upon the surface of the ground. The pillars are more delicate, and the decorations of a less severe cast than those of Egypt.

In order to illustrate what has been advanced in this cursory view, we shall lay before the reader some details respecting the architecture of these three countries.

OF EGYPTIAN ARCHITECTURE.

Egyptian architecture.

Egypt being a country of small extent, and having been early and frequently conquered, the history of its ancient cities, palaces, and temples, was beyond the reach even of Herodotus. This parent of history only commences his account after the translation of the seat of empire to Memphis, and his personal intercourse with the country was not until a hundred years after its conquest by Cambyses. The origin and progress, therefore, of the powerful state which raised Thebes, and the other unrivalled edifices with which Upper Egypt was crowded, is to us totally unknown.

From the seat of empire having been first established at Thebes, and next at Memphis, we are led to conclude, that the original progress of colonisation was made in the same direction; but the periods or manner of this progress, as far as regards the cities of Upper Egypt, are involved in impenetrable obscurity. The forms of architecture and sculpture having been strictly determined, it is only from some shades of difference in the perfection of the workmanship of the latter, that we are led to conjecture that Apollinopolis, Tentyra, and Latopolis, are later works than the great edifices of Luxor and Karnac.

Tentyra, &c. later than Luxor, &c.

From the magnificent description of Thebes by Homer, we learn that it had risen to great importance previous to the Trojan war, or about 1200 years B. C. Memphis is said to have been built eight generations after Thebes, and Cambyses invaded Egypt 525 B. C.; so that for a period of 700 years, this country is known to have abounded in wealth and population; and when it is considered, that during this time the command of this wealth was in the hands of an able, artful priesthood, and unceasingly applied to the constructon of religious and royal edifices, we shall, after recollecting what was performed in Europe by similar means during a few centuries, be convinced, that the period before mentioned was alone quite sufficient for accomplishing even the justly celebrated works of the Thebaid.

Cambyses.

With the invasion of Cambyses terminated the splendour of Upper Egypt. He carried with him not only conquest but destruction. His warfare was not merely with the people, but with their palaces and religious structures. He carried off not only the spoils but the artists, leaving this once splendid valley a deplorable scene of ruins; and such is the fate of empires, that not more than two centuries had elapsed, when even these ruins suffered a further dilapidation from the destroyer of the Persepolitan palace of Cambyses. But notwithstanding all this, and also the repeated efforts of the more powerful Romans, and the natural waste of 3000 years, the magnificent and indestructible remains of Egyptian architecture at this day, exhibit a striking picture of that once powerful and learned people.

Alexander.

Structures of three different forms in Egypt.

Upper Egypt contains structures of three distinct forms. 1. The simple pyramid. 2. Apartments inclosed by sculptured walls with flat roofs, supported by rows of columns, and connected by open porticos. And, 3. Caverns, grottos, or tombs. We are here also without historical evidence, with regard to the priority or succession of these several modes. Some are of opinion, that caverns furnished first dwellings, and also places of worship, and that to these succeeded the simple pyramid; whilst others contend, that the colonnades were raised in imitation of groves of trees, in which were the earliest places of worship. The simplicity of the pyramid, and its having also been formed by the Spaniards in Mexico and Peru, would induce us to assign it a very early æra; but the Egyptian pyramids being situated at the northern extremity of the valley, in the neighbourhood of Memphis the *second capital*, we are at a loss to reconcile this circumstance with the previous reign of Thebes. If caverns have been the first habitations of the early inhabitants of Egypt, they must have occupied only what are now reckoned natural caves; for the excavations appropriated for tombs are arranged with great skill, and contain some of the most perfect sculptures and paintings. Indeed, from extensive ranges of ornamental tombs being constantly found adjacent to each great city, they evidently formed a part of the establishment, and they are also known to have enjoyed a very important place in the ancient Egyptian mythology.

Isle of Philee in the Nile.

The genius of Egypt appears with splendour at the very southern boundary of the empire; for the island of Philee, situated in the river Nile above the first cataract, (300 yards in length, and 140 in breadth,) has been wholly covered with temples. It was reckoned the sepulchre of Osiris, and deemed so sacred, that priests only were allowed to enter it. Some of the edifices appear very ancient, and others as if they had never been finished. In the latter, the sculpture is most perfect. Here the symbol of the hawk is very frequent.

Sepulchre of Osiris.

Isle of Elephanta.
Nilometer.

A little to the north of Philee is the isle of Elephanta, (2600 yards long, and 800 broad.) It was in a chamber in the middle of this island that the nilometer was placed. The temple has been dedicated to Horus, the Egyptian Apollo. The sculptured figures have more of the negro than in any other place. A granite statue of Osiris found here has never been finished. There is here a small peristyle temple apparently very ancient. Strabo found half the inhabitants of this island to be Ethiopians. Denon says, the temple was dedicated to the god Cneph, or the good genius, and that the symbols are serpents; and he thinks temples of this sort the most ancient. At Ombus, which is situated on the eastern side of the Nile, a temple has been dedicated to the crocodile.

Ombus.
Crocodile.

Apollinopolis.

Continuing down the valley, we arrive at Apollinopolis. It is situated on the western side of the Nile, in which is one of the finest, and, next to Thebes, the largest temples in Egypt. It was dedicated to Horus. The two moles which ornament the entrance are nearly in contact. The door is higher than in any other temple. It opens into a vast court, surrounded by columns, in form of a peristyle. The lodgings for the priests were behind the peristyle. The portico is formed of six columns in front, and three deep. The interior is arranged similar to Dendera, or Tentyra.

Edfou.

At Edfou, is a small temple to Typhon. There are here figures of the bad genius. The pictures represent the triumph of Hippopotamus.

Latopolis.
PLATE CXLVIII.

Still moving northward on the western side of the river, is Latopolis, which has a beautiful portico of six columns in front, and four deep; (see Plate CXLVIII.) the capitals differ, but are all elegant. The temple was dedicated to Jupiter Ammon. Here were found emblems of sacrifices of rams. There are four entire zodiacs at this place. On the other side of the river facing Latopolis, is a small temple, remarkable for having a gallery formed all round in the thickness of the wall.

Thebes.
Karnac.
PLATE CXLVIII.

At Thebes, there are magnificent ruins on both sides of the river; but Karnac and Luxor are on the eastern side, distant from each other about two miles. Karnac, (see Plate CXLVIII.) the greatest edifice in Egypt, Denon says, was dedicated to Priapus. The mole looks towards the Nile; it is 140 paces in length, and 25 in thickness: this leads to a court 110 paces in length, and the same in breadth. Two ranges of six columns, conducts to a portico composed of 136 columns. The two middle ranges of these are eleven feet diameter, the others are seven feet; the length of this vestibule is 78 paces, the breadth the same as the mole: it leads into a court, where there are four obelisks, and twelve colossal figures, each with a cross on its breast. Two other courts conduct to what is supposed the apartments of the kings; those of the king and queen are distinguished by doors of black granite. Adjacent to the great palace are many other buildings of great extent, connected with it by avenues of sphinxes, lions, and rams; some of the avenues extended towards Luxor, a distance of 1200 yards. The alley of lions is well preserved; they are 90 in number, and each is fifteen feet long, placed couchant upon a pedestal, about three feet in height, and ten feet asunder. Facing the moles, which condnct to the court of obelisks of the great

Avenues, sphinxes, lions.

Sculptures upon the exterior of the palaces.

palace, are two, and sometimes four colossal statues of sand stone, or granite; they are either seated, or in the act of marching, the arms hanging upon their sides, armed with a crooked poignard. The pictures which decorated the exterior of these different palaces, represent military subjects, sieges of cities, combats, offers of peace and submission by barbarians, triumphs of heroes who have conquered; the hero is represented by a young man of six feet high, mounted on a car precisely of the form used by the Greeks. The soldiers are scarcely one-fourth of this size. The enemies, put to the route, are men with beards, with a cap like the Spaniards. The Egyptians are armed with arrows; the barbarians with a buckler; they have also crooked sabres, lances, javelins, and a straight sword; the bridle of the horses resembles those still used in Arabia.

Plate CXLIX.

In approaching Luxor, (see Plate CXLIX.) the great objects crowded together at the entrance, are new to a European. In front of two great moles, 55 feet high, and distant only fourteen paces, stand two obelisks, 92 feet high, and between the obelisks and moles there are two colossal statues of black granite, each 38 feet high.

Memnonium or western bank.

Two great statues.

Plate CXLIX.

Tombs of the kings.

The first colonnade is ruined, the second still exists; it is formed of two ranges of eight columns; the total height being 56 feet, andthe diameter nine feet. At 28 paces to the right and left of the great colonnade, were two other ranges, 30 feet high, and four feet diameter. These structures, are on the eastern bank of the Nile. On the western side, on the scite of the Memnonium, is the immense statue of red granite, thrown down by Cambyses: its stature is 64 feet. Another smaller statue of rose granite is reckoned the finest in Egypt. Between the Memnonium and Medinet Abou, are two of the greatest statues in Egypt; their proportion is 55 feet; they are seated on pedestals, which are eleven feet high, (See *Collection of Fragments*, Plate CXLIX.) The space between Memnonium and Medinet Abou, which is about a mile and a quarter, is covered with fragments of colossus. Here appears to have been what Diodorus Siculus called the tomb of Osymandes. The palace of Medinet Abou has still preserved a peristyle, 55 paces long, and 65 in breadth, formed by four rows of columns, placed on the four sides of the court. The columns are 45 feet high, and seven feet diameter; the materials good, and the execution fine. In the hieroglyphics, the large figures have two inches relief, the smaller ones one inch. On the exterior of the palace wall, a bas relief represents a chase of lions, and an attempt at a descent by strangers, whose dress very much resembles that of Indians. The Egyptians oppose the descent by sea and land, and the barbarians are all routed. Under this picture is seen the march of troops heavily armed, and others armed lighter. The tombs of the kings are situated about 3¾ miles from the river, in a narrow valley, between the mountains of Lybia. In the time of Strabo, 17 of these tombs were found, and, including a grotto near the Memnonium, there is still the same number. They will be particularly described in their proper place.

Such are the outlines of the ancient and justly famed capital of Upper Egypt, as given by learned travellers; and more especially by Denon, and the French Commission of Arts, who examined it with zeal and care, under the protection of an armed force.

Tentyra.

Plate CXLIX.

Leaving Apollinopolis parva, and Coptos, on the eastern bank of the river, we find Tentyra, situated on the western bank. Here three temples have existed; the greatest, (see Plate CXLIX.) dedicated to Isis, is upon the same plan as that at Apollinopolis. The façade is 72 paces in breadth, and 145 in length. As the particulars will be detailed under the head of the Practice of Architecture, we shall here only remark, that there are two fine zodiacs to be seen; and that the sculpture of the human faces is much superior to that in any other place in Egypt. There was another smaller temple also dedicated to Isis, and a third to Typhon. The ruins of the city of Tentyra are said to cover about a square mile.

Panopolis, Lycopolis, Hermopolis.

Heliopolis.

In descending the valley, there are still the remains of Panopolis, Lycopolis, and Hermopolis, some of which yet exibited porticos, having eighteen columns; besides these, a multitude of fragments, in various other places, are evidence of temples or palaces having once existed. At Heliopolis, there remain only a solitary sphynx and an obelisk, to mark the scite of the city of the sun where Moses, Herodotus, and Plato were instructed in the learning of the Egyptians.

Five palaces and thirty-four temples in Upper Egypt.

Upon the whole, there are yet, it is said, in existence, in Upper Egypt, five palaces and 34 temples: the most ancient have been constructed chiefly with sand stone, and a few with calcareous stone. Granite was only used in obelisks and colossal statues.

Sanctuary of Minerva at Sais, a cube of sixty feet.

After the seat of empire was removed to Memphis, granite was made use of. The temple of Isis of Bahbeit was built of it. Immense masses were extracted and carried from Elephanta. The sanctuary of Minerva at Sais, and Latona at Butos, said to be cubes of sixty feet, were floated 600 miles, from Philee and Elephanta.

Memphis.

Pyramids.

The city of Memphis, the second capital of Egypt, is so completely destroyed, that its precise situation has not been clearly ascertained. It contained the celebrated temple of Phtha, (the vulcan of the Greeks); also one to Osiris, where the sacred ox was kept, and one to Serapis with an avenue of sphinxes at some distance. Strabo says, that there were many palaces situated along the side of a hill stretching down to lakes and groves, 40 stadia from the city; and it is known that they crossed lakes to convey their dead to the tombs, which were hewn out of the rocks. But the annihilation of the Memphian temples and palaces are compensated by the existence of the pyramids, which are alone sufficient to engage the attention of mankind. At a place called Sakkara, they are scattered over a space of twenty miles by seven. About thirty still exist, and there are traces of many more. The three largest are situated at Geez, and named from their founders Cheops, Chephren, and Mycerines. That of Cheops, which is the largest, is 448 feet in height, and 728 on each side of the base; Chephren 398 feet in height, 655 on each side of the base; and Mycerines 162 feet in height, and 280 on each side of the base.

The stone with which they are built is calcareous, fine grained, of a light grey colour, easily cut, light and porous, and readily imbibes water. By analysis it contains 95 carbonate of lime, 4 alumine, and 1 oxide of iron. The masonry is laid in mortar similar to that used in Europe.

The learned Mr Greaves, after much discussion, determines, from the best authorities, that the large pyramid was built 490 years before the first Olympiad, or about 3000 years ago.

Sphynx.

A little to the east of the second, or Chephren's pyramid, is the sphynx, cut out of the same sort of rock upon which the pyramids are built; the length is about 95 feet, and its height from the knees to the top of the head 38 feet.

It is still a doubt for what purposes these great edifices were constructed, whether for temples or sepulchres, or both. These points will be discussed at some length, and the particulars of their construction detailed under the articles TOMB and PYRAMID; but, in this ge-

Tombs.

neral historical sketch, we cannot avoid mentioning, that, from the peculiar notions the Egyptians held respecting the importance of preserving their bodies after death, they appear to have devoted much time and labour upon their sepulchres and tombs. In the whole of Upper Egypt, adjacent to each city, numerous tombs are always found excavated in the neighbouring mountains; the most extensive and highly ornamented are nearest to the base; those of smaller dimensions and less decorated occupy the middle; and the most rude and simple are situated in the upper parts. Those adjacent to Thebes, reckoned the tombs of the kings, are composed of extensive galleries, 12 feet broad and 20 high, with many lateral chambers. They are ornamented with pilasters, sculptures, stucco, and paintings; both ceilings and walls are covered with emblems of war, agriculture, and music; and, in some instances, with shapes of very elegant domestic utensils; and always representing offerings of bread, fruit, and liquors. The colours upon the ceilings are blue, and the figures yellow. We have, in Plate CXLIX. represented the entrance to those at Silsilis, situated between Edfou and Ombus.

Plate CXLIX.

Upper Egypt dilapidated by Cambyses,

and Alexander.

Alexandria.

Old Cairo.

From this sketch it will be evident, that the whole of Upper Egypt has been crowded with structures, composed in a style of architecture the most sublime and imposing which the world has ever beheld. It has already been mentioned, that Cambyses, from political jealousy or fanatical zeal, terminated his conquest of this country with a destruction bordering on frenzy; and also that Alexander, though a more liberal conqueror, after having, in a fit of intoxication, destroyed the Persepolitan Palace, contributed to the further dilapidation of the structures of the Thebaid, by using their materials in constructing the city of Alexandria. This city is one of the few instances, we distinctly know, where, under the direction of experience and intelligence, an entirely new situation has been chosen, and all the parts conducted according to a regular plan. Here the prince was the son of Philip and the pupil of Aristotle, and the architect (Dinocrates) was an enterprising Greek. The materials and mode of conveyance had all the perfection which the experience of 1000 years could afford; and the wealth and exertions not only of Egypt, but of all Asia, could be rendered subservient to this favourite project. The plan was extensive and magnificent; and a succession of wise and good princes rendered it, by means of Egyptian materials and Greek taste, the richest and most perfect city the world has beheld. Its chief features were two streets of great breadth, which crossed each other at right angles, and having all the smaller ones parallel to these. Besides all the private buildings, constructed with marble and porphyry, there was an admirable temple to Serapis, and another to Neptune; also a theatre, amphitheatre, gymnasium, and circus. The palace occupied one quarter of the city; but within its precincts were a museum for learned men, extensive groves, and a temple containing the sepulchre of Alexander. A mole of a mile in length extended from the Continent to the Isle of Pharos, where the famous lighthouse was constructed. This magnificent city maintained its importance for about 1000 years, under the Greek and Roman emperors. In the time of Augustus, it contained 300,000 free people, probably in all about 900,000; but, in the year 638, it was taken by the Saracen General Amrou, and, in 857, its walls were demolished. The foundation of Fostat, or Old Cairo, were laid by Amrou, where he pitched his tent previous to laying siege to Alexandria. Modern Cairo rose upon its ruins, and has been enriched with the spoils of Alexandria; from whence, it is said, 40,000 columns of granite, porphyry, and marble, have been brought, and erected in the mosques and private dwellings.

Of Indian Architecture.

Indian architecture.

Although what relates to India was anciently but very imperfectly known to the western world, yet such is the change in human affairs, and the eagerness with which every matter relating to India has of late been investigated, that we are now furnished with accounts fully as ample as those relating to Egypt or Persia. In the following brief relations we shall be guided by some excellent papers, by Sir William Jones and others, in the *Asiatic Researches;* Robertson's *Disquisitions respecting Ancient India;* the learned and laborious work of Maurice on *Indian Antiquities;* and the several other authorities quoted for particular descriptions.

Cities and palaces.

Oude.

Canouge.

Court removed to Delhi.

Canouge restored.

In India, the cities and palaces were on a scale with its great wealth and population. They were generally indebted for their origin to the favour of powerful princes, and successively became the centre of the riches and traffic of the East. In the historical poem, called the Mahabbarit, (or History of the Great War,) translated by Abul Fazel, the secretary or minister of the great Akbar, it is said, that Oude, the capital of a province of that name, to the north east of Bengal, was the first regular imperial city of Hindostan, and that it was built in the reign of Krishen, one of the most ancient rajahs. The Ayeen Akbery (vol. ii. p. 41.) represents Oude to have anciently been 148 coss (or about 259 miles) in length, and 36 coss (or about 63 miles) in breadth; but this bears more a resemblance to a province than a city. This city, says Sir W. Jones, "extended, if we may believe the Bramins, over a line of ten yojans, (or 40 miles.) It is supposed to have been the birth-place of Rama." According to the Mahabbarit, Oude continued the imperial city 1500 years, until about the year 1000 before the Christian æra, when a prince of the dynasty of the Surajas, who boasted their descent from the Sun, erected Canouge upon the banks of the Ganges, and made the circumference of its walls 50 coss, or about 87 miles. Strabo, from Megasthenes, who had seen Canouge, says it was situated as the confluence of another stream with the Ganges; that its form was quadrangular, the length 80 stadia, breadth 15, or, taking the mean stadium of the ancients, about 8 miles by 1½; that it had wooden fortifications, with turrets for archers to shoot from, and was surrounded by a vast ditch, (*Strabo*, lib. xv. p. 667.) Arrian calls it the greatest city amongst the Indians; he says, that it was situated at the junction of the Erannaboa with the Ganges: he gives the same dimensions as Strabo; and says, that there were 570 towers on the walls, and 65 gates. Diodorus Siculus, lib. xvii. p. 678, says, that when Alexander passed the Hyphasis, he was informed, that, on the banks of the Ganges, he would meet the most formidable sovereign of India, called Xambranes, king of the Gangarides, at the head of 20,000 horse, 200,000 foot, 2000 war chariots, and 4000 fighting elephants. The Mahabbarit states, that Sinkol, a native of Canouge, brought into the field, against Affrasiah, king of Persia, 4000 elephants, 100,000 horse, and 400,000 foot. But that after Delu had founded Delhi, and established his court there, Canouge declined, and was involved in civil discord;—still we learn from the same authority, that Sinsarchand, or Sandrocottus, the successor of Porus, restored Canouge to its ancient splendour; and that here, about the year 300 before Christ, he entertained the ambassadors from Seleucus, the successor of Alexander, and that Megasthenes was amongst the number. In the beginning of the 5th century, Ramdeo Rhator (or the Mahratta) entered Canouge in triumph, and reigned there 54 years. The last king under whom this city may be considered as the metropolis of a great empire was Maldeo, who, about the beginning of the 6th century, added Delhi to his dominions. At this time, Canouge was said to contain 30,000 shops, in which areca was sold. Although not the metropolis, it long after continued of great consequence. About the year 1000, when Sultan Mahmed invested it, it is represented as a city which, in strength, had no equal. It became an appendage to the empire established by Mahmed. *Ferishta*, vol. i. p. 27.

Major Rennel is of opinion that Canouge and Palibothra were the same. Others endeavour to prove the contrary; and that both may have existed at the same time capitals of the Prasii, as Delhi and Agra have done in later times.

Delhi founded by Delu, 300 B. C.;

The precise period of the origin of Delhi is not correctly ascertained: According to the Ferishta, it was founded by Delu, who usurped the throne about 300 years before Christ. The Ayeen Akbery fixes it about the commencement of this æra, and informs us, that twenty princes of the name of Bal, or Paul, followed in regular succession for 437 years; that the last of its native princes was Pithoura, when it was conquered by the Mahomedan slave Cattub, named by Herbelot, Cathbaddin Ibek, who made Delhi the capital of the vast empire he established in Hindostan; and that each successive monarch of the Mahomedan dynasty adorned it with splendid edifices, appropriated to the purposes of religion and commerce. At the invasion of Timur Bec, it had arrived at the highest distinction for commerce and wealth, being then the centre of the traffic carried on between Persia, Arabia, and China. Timur entered it on the 4th July 1399; and on the 13th of the same month, this celebrated city was destroyed. Sherifedden, the Persian historian, says, that Old Delhi was celebrated for a mosque and palace, built by an ancient Indian king, in which were 1000 marble columns. Under the dynasty which succeeded Timur, it recovered its original splendour, and was again ornamented with mosques, baths, caravanserahs, and sepulchres.

destroyed in 1399, by Timur.

Agra founded by Akbar.

Delhi restored;

The great Akbar, the glory of the Timur house, having fixed his residence at Agra, Delhi, of course, experienced a partial eclipse; but in 1647, according to Fraser, Ischaim Shah, the grandson of Akbar, restored Delhi under the name of Ischaimbad, where he built a magnificent palace, formed extensive gardens, and constructed a throne in the shape of a peacock, whose expanded tail was entirely composed of diamonds, and other precious stones. It continued the capital of Hindostan till 1738, when it was sacked by Nadir; and afterwards repeatedly by Ahmed Abdallah, from 1756 to 1760, when it was totally destroyed. During the reign of Aurenzebe, it was said to contain two millions of habitants:

totally destroyed 1760.

Lahore.

Lahore is situated to the north-west of Delhi, on the banks of the Rauvee, the ancient Hydraotes: it appears to have been the Bucephalus of Alexander. Jeipal, the rajah of Lahore, during the incursions of Subuitagi, and his son Mahmud, defended his possessions with great bravery; and so great were his riches, that, when taken prisoner, around his neck alone was suspended sixteen strings of jewels, each of which was valued at 180,000 rupees, and the whole at L. 320,000. Lahore continued to flourish under the sultan of Cosro, and was the imperial seat of Cuttub before he removed it to Delhi; even afterwards it remained the general storehouse for the traffic of Persia, Arabia, India, and China. It was restored by Homaion, who, amongst other magnificent buildings, erected a palace, which was completed by Ischaim Geer, the son of Akbar. This palace, according to Mr Finch, who visited it in 1609, had twelve gates, nine towards the landside, and three towards the river. He says, the rarities were too numerous and glorious to be represented in a description; that the mahls, courts, galleries, and rooms of state, were almost endless; and that, in the king's lodgings, the walls and cielings were overlaid with plates of gold. M. Bernier, who was in this city in the suit of Aurengzebe, speaks of this palace as a high and magnificent building, but then hastening to ruin.

Visited in 1609 by Mr Finch.

Agra

Agra, the Agara of Ptolemy, situated in 27° 15′ north latitude, on the bank of the Jumna, we have already observed, was raised to splendour by the great Acbar. He caused the earthen wall, by which the city had been inclosed by the Patan monarchs, to be taken away, and replaced by one of hewn stone, brought from the quarries of Fettipore. He collected the most skilful artificers from every part of his dominions; and the palace alone employed above 1000 workmen for twelve years. The castle was built in the form of a crescent, upon the banks of the Jumna; and in a line with it were ranged the palaces of the princes and great rajahs, intersected with canals and beautiful gardens. Acbar also erected many caravanserahs and mosques. He invited foreigners of all nations; he built them factories; and permitted to all the free use of their religion. It was soon crowded with Persian, Arabian, and Chinese merchants, besides those immediately from European settlements. But when Ischaim removed the imperial insignia and treasures to Delhi, and made it the residence of his court, Agra sunk rapidly to decay.

made a free city by Acbar.

These five imperial cities seem, with regard to extent, splendour, and wealth, to have exceeded the greatest cities of the western world: And, beside these, many others were almost of equal magnificence; for Chundery is said to have contained 384 markets, and 360 caravanserahs; and Ahmedabad was once so large as to require to be divided into 360 quarters. Maurice, *Ind. Antiq.* vol. i. pp. 118, 124.

These extensive and proud cities, were evidently the symbols of temporary policy and power, and have passed away, like so many splendid scenes on the great theatre of the East. From the particulars which will be detailed under the Practice of Architecture, we shall be able to form some notion of the eastern manner of building; but as the religion of India has been more permanent than their political relations, it is from the sacred edifices we are to trace most distinctly the characters of Indian architecture, and be enabled to judge how far they have any affinity with those of other nations. Of their large temples (pagodas) we find accounts of five different forms.

Temples in five different forms.

Pyramids.

1. Simple pyramids constructed of large stones, and diminished by regular recesses or steps, as at Deogur and Tanjore; the exterior rude, and the interior having only lights from without by a small entrance door; illuminated by a profusion of lamps, with the exception of a chamber in the middle, which has only a single lamp. Aquetil says, that to him one of the mountains of Canara seemed hewn to a point by human art.

Excavations.

2. The second kind were formed by excavations in the sides of rocky mountains. Abul Fazel (*Ayeen Akbery*, vol. ii. p. 208.) says, that, in the soobah of Cashmere, in the middle of the mountains, 12,000 recesses were cut out of the solid rock. From Captain Wilford's paper on Caucasus, inserted in the sixth volume of the *Asiatic Researches*, we learn, that an extensive branch

of the Caucasus was called by the Greeks Parapamis, obviously derived from Para Vami, the pure and excellent city of Vami, commonly called Bamiyan. It is situated on the road between Balkh and Cabul, and, like Thebes in Egypt, consists of vast numbers of apartments and recesses cut out of the rock; some of which, on account of their extraordinary dimensions, are supposed to be temples. There are also, at that place, two colossal statues, one of a man eighty ells high, and another of a woman fifty ells high, erect, and adhering to the mountain from which they are cut. At Salsette, Elephanta, and Vellore or Ellora, the excavations were not only extensive, but were divided into separate apartments, with regular ranges of sculptured pillars and entablatures, and the walls and ceilings covered with multitudes of figures of their genii, deutahs, men, and women; and various animals, such as elephants, horses, lions, &c. all of the most excellent workmanship. See Plate CLI. and CLII.

Plates CLI. and CLII.

Square or oblong courts.

3. A third set were composed of square or oblong courts of vast extent. The circumference of the outward wall of that in the island of Seringham, adjacent to Trichinopoly, is said to extend nearly four miles. The whole edifice consists of seven square inclosures, the walls being 350 feet distant from each other. In the innermost spacious square are the chapels. In the middle of each side of each inclosure wall there is a gateway under a lofty tower: That in the outward wall which faces the south, is ornamented with pillars of single stones, thirty-three feet long, and five diameter, (Voyages *de M. Sonnerat*, tom. i. p. 217; and Robertson's *India*, p. 268.) Tavernier describes the Pagoda of Santidas, in the Guzzerat, as consisting of three courts paved with marble, and surrounded with a portico supported by marble columns: the inside of roof and walls formed of mosaic work and agates, and all the portico covered with female figures cast in marble. Aurenzebe profaned this temple by killing a cow within its precincts, and converting it into a Turkish mosque. At Chittambrum, on the coast of Coromandel, there is only one court, 1332 feet in one direction, and 936 in another, with an entrance gateway under a pyramid 120 feet high, and the ornamental parts finished with great delicacy. John Call, *Phil. Trans.* vol. lxii. p. 354. Orme's *Hist.* vol. i. p. 178.

In the form of a cross.

4. A fourth sort, as Benares Pagoda, in the city of Casi, which from the earliest times was devoted to Indian religion and science. The temple is in the form of a cross, with a cupola terminated by a pyramid in the centre, and having also a tower at each extremity of the cross. From the gate of the Pagoda to the Ganges there is a flight of steps. *Tavernier*, tom. iv. p. 149. Rouen edit.

Circular.

5. A fifth are made in a circular form, as the celebrated pagoda of Juggernaut, which Hamilton compares to an immense butt, set on end. Juggernaut, only another name for the god Mahadeo, who is represented by the vast bull which juts out of the eastern aspect of the building. It is the seat of the arch-Bramin of all India, and its sacred domains are said to afford pasturage for 20,000 cows.

Bezoara or Buswara.

Besides these general terms, if our limits permited us to trace those interesting structures through the various districts of this extensive country, many different arrangements might be described; but, for the present, we must be satisfied with mentioning the pagoda of Bezoara, (or Buswara of Major Rennel) now a fort upon the Kistna river; it was not inclosed with walls, but erected upon 52 lofty columns with statues of Indian deities, standing between the columns. It was situated in the midst of an oblong court, round which there was a gallery raised on 66 pillars like a cloister. (*Voy. des Ind.* tom iii. p. 226. Rouen Ed. 1713.) Near this, on a hill ascended by 193 steps, was another pagoda of a quadrangular form, terminated by a cupola.

Temples placed on the banks of the Ganges, &c.

These temples were generally erected on the banks of the Ganges, Kistna, and other sacred rivers for ablution. Where there was no river, a tank or reservoir of a quadrangular form was constructed and lined with free-stone or marble, with steps descending into them. Crawford observed many 300 or 400 feet in breadth. (Crawford's *Sketches*, vol. i. p. 106.) At the entrance of the principal pagodas, there is a portico supported by rows of lofty columns, and ascended, as in the case of Tripetty, by more than 100 steps; under these porticos, and in the courts which generally inclose the buildings, multitudes attend at the rising of the sun, and having bathed and left their sandals at the border of the tank, impatiently await the unfolding of the gates by the ministring Bramin. *Thevenot.*

Sculptures.

We must reserve, until we come to treat of the Practice of Architecture, many particulars relative to those splendid edifices, which, with the Plates accompanying them, will afford a more distinct view of the nature of their arrangements and appropriations; but it will be proper in this place to notice some leading circumstances respecting the Indian sculptures, with a view to ascertain what affinity they had to those in Egypt.

Excavations in the Soubah of Cashmere.

Colossal statues.

Juggernaut black stone.

Two tygers.

From the Ayeen Akbery, and Captain Wilson's paper on Caucasus, we find, that in the Soubah of Cashmere, between Balkh and Cabul, in the numerous excavations, there are 700 places where the figure of a serpent is carved; and that near these excavations, there are sculptured in rock, on the side of the mountain, figures of 15, 50, and 80 ells high; that in the great temple of the Sun, which was near Juggernaut, and said, by the Ayeen Akbery, to have consumed, in the expence of building, the whole revenue of the Orissa for twelve years; that in front of the gate, there was a pillar of black stone, of an octagon form, 50 cubits high; that at the eastern gate, there were two elephants, each with a man on his trunk; at the western gate were figures of horsemen, completely armed; and at the northern gate two tygers, who had killed two elephants, and were sitting upon them. That in one extensive apartment, there is a large dome constructed of stone, upon which is carved the sun and stars, and round them a border of human figures. In the Pagoda at Juggernaut, Hamilton describes the idol as a huge black stone, of a pyramidal form; and there was a bull, representing the god Mahadeo, jutting from the wall of the eastern aspect. Tavernier observed a conspicuous idol of black stone in the temple of Benares; and that the statue of Creeshna, in his celebrated temple of Mathura, was of black marble. In the great Pagoda at Elephanta, the bust of the triple headed deity measures 15 feet from the base to the top of the cap, the face is five feet long, and it is 20 feet across the shoulders. Along the sides of the cavern are colossal statues, to the number of 40 or 50, from 12 to 15 feet high; some have a sort of helmet of a pyramidal form; others a crown with devices; others display bushy ringlets, some with curled, and others with flowing hair; many have four hands, some six; with sceptres, shields, weapons of war, and symbols of peace. At the west end of the Pagoda, there is a great dark recess, 20 feet square, totally destitute of ornaments, except the altar in the centre, and the gigantic figures which guard the several doors which lead into it. Niebuhr says, these figures are eight in number; they are naked, and 13½ feet high;

Colossal statues at Elephanta.

Salsette.

their heads, decorated like the other statues, have rich collars round their necks; and jewels of great size in their ears. In the before mentioned recess, the Lingam divinity is represented. The Pagoda at Salsette exceeds that at Elephanta; the two colossal statues immediately before the entrance of the grand temple are 27 feet high; they have caps and ear-rings. There are here two hundred figures of idols; 90 of which are in and about the great pagoda. In the interior spaces which recede from the apartments, the Lingam is represented. Many of the sculptures in these grand temples have reference to the astronomical, as well as mythological notions prevalent in India.

Vellore.
Plates CLI. and CLII.

At Vellore, Ellore, or Ellora, (Plates CLI. and CLII.) the sculptures, &c. are still more extraordinary; and all are dedicated to the Lingam or Mahdeu. The height of the grand pyramid is here 90 feet; the smaller ones 50 feet; the obelisks 38 feet. The elephants on each side of the court are larger than life; and there is an apartment for the Bull Nundee. See C. W. Malet's paper, *Asiatic Researches*, vol. vi. p. 383.

Eswara and Isi the same as Isis and Osiris.

Sir W. Jones (*As. Res.* vol. i. p. 253.) is of opinion, that the Eswara and Isi of the Hindoos, are the Isis and Osiris of Egypt. He says, that the word Misr, the native appellation of Egypt, is familiar in India; that Tirhoot was the country, asserted by a learned Bramin, to be that in which an Egyptian colony of priests have come from the Nile to the Ganges and Yamma (Jumna). And again, in his third annual discourse, the remains of architecture and sculpture in India, prove an early connection between this country and Africa, the pyramids of Egypt, the colossal statues of the Sphinx, and the Hermes Canis, which last bears a great resemblance to the Varahavatu, or the incarnation of Vishnu, indicate the style and mythology of the same indefatigable workmen, who formed the vast excavations of Canarah, the various temples and images of Buddah, and the idols which are continually dug up at Gaya.

Kempfer asserts, that the great Indian saint, Buddha, was a priest of Memphis, and having fled to India, introduced the worship of Apis. (Kempfer's *Hist. Japan.* vol. i. p. 38, ed. 1738.)

Athanasius Kircher is of opinion, that after Cambyses had murdered Apis, the most revered of the Egyptian deities, he committed wanton cruelties on the priests, and destroyed their magnificent temples, as related by Herodotus, that the priests flying into the neighbouring countries of Asia, propagated the superstitions of Egypt.

The lotus was anciently in Egypt, and still in India, held sacred. Herodotus calls it the lily of the Nile. The Egyptian priests had a sacred language, so have the Bramins. The Egyptians, according to Diodorus Siculus were divided into five tribes, of which the first was sacerdotal. The Indians are separated into four, besides an inferior one, named Buzzer Sunker.

Father Loubere, who went ambassador from the king of France to the king of Siam, in 1687, thinks the superstition of Boodh no other than the Sommonacodom, or stone deity of the Siamese, originally from Egypt. He says, that their astronomers, have fixed the death of Sommonacodom to the year B. C. 545, and that it was then their first grand astronomical epochs commenced. Now, by Usher, Cambyses invaded Egypt in 525. Loubere adds, that the Siamese priests live in convents, which consist of many cells ranged within a large inclosure; that in the middle of the inclosure stands the temple; that pyramids stand near to and quite round the temple, all within four walls. See Loubere's *Hist. of Siam,* in Harris's *Coll. of Voy.* vol. ii. p. 482.

Sir W. Jones thinks, that the great statue of Narayen, or the Spirit of God, who, at the beginning, floated on the waters, as that statue is now to be seen in the great reservoir of Catmander, the capital of Nipaul, is the same as the Cneph of Egypt, under a different appellation; both statues are made of blue marble. See *Asiatic Researches*, vol. i. p. 261.

Mr Call has published a drawing of the signs of the zodiac, which he found in the ceiling of a choultry at Verdapettah, in the Madurah country, viz. Brahma painted in pagodas, in the act of creation, floating over the watery abyss, reclining upon the expanded leaf of lotus, Osiris found in the same attitude, recumbent on the same plant, in the Egyptian monuments. Maurice, vol. ii. p. 394.

Of Persian Architecture.

Persian architecture.

The south western districts of Asia, although the centre from whence, we have reason to think, mankind originally spread in all directions, has undergone such frequent and complete changes, that we have scarcely any vestiges of its very ancient edifices left, and even the descriptions of the earliest historians convey but imperfect ideas of their magnitude or forms; the reason of this will be evident, from considering that the dominion has been successively in the hands of the Assyrians, Medes, Persians, Greeks, Romans, Saracens, and Turks.

General remarks.

Although there may be reason to suspect some exaggeration in the accounts transmitted by Herodotus and others, it is clear they were the results of the enquiries of curious and able men; they at least prove, that the magnitude of the cities, palaces, and temples of Assyria and Chaldea, must have been very great; and when we consider the population and riches of the empires of which these cities were the capitals, and that to their decoration every despotic monarch would apply the whole resources of his empire, we should hesitate in assigning the limits of their operations, particularly when it is considered, that although despotism cannot create genius, or oblige it in a short period to produce fine architecture, sculpture, and painting, yet when magnitude alone is concerned, simple manual labour to almost any extent was perfectly within its power. Those who will take the trouble of acquiring a distinct knowledge of what has been performed during the last 50 years, in extending towns, constructing harbours, navigable canals, roads, and bridges, within the island of Great Britain alone, will not be astonished by the accounts given of the vast cities of the east.

Babylon and Nineveh appear both to have existed at the same time, and to have been nearly of the same magnitude, viz. from 48 to 60 miles in circumference.

Babylon.

Babylon was situated in 32° 34′ N. Latitude, and 44° 12′ 30″ E. Longitude, in the extensive and rich plain of Shinar, at the top of the Delta, formed by the Euphrates and the Tigris. Its original founder is said to have been Nimrod, 2000 years B. C. but it was rebuilt by the celebrated Assyrian queen Semiramis, 1200 B. C. and enlarged and perfected by Nebuchadnezzar, about 600 B. C. It was divided by the Euphrates passing through it from north to south, the old city being on the east, and the new on the west side of the river, both together forming a square 15 miles on each side. It was divided by 25 streets 150 feet broad, running in each direction, and crossing at eight angles, besides streets of 200 feet in breadth, passing along the inside of the walls; the whole space was thus divided into 676 squares, along which the houses were built at some distance from each other. The intermediate spaces were occupied by gar-

Streets.

Walls.

River.

Bridge.

Palaces.

Temple of Belus.

dens and groves of trees. The walls which encompassed the city are said by Herodotus to have been 385 feet high, and 87 in thickness; they were built of brick, laid in a mortar made of bitumen; they were surrounded by a ditch, from which the bricks had been made. Darius Hystaspes afterwards reduced them to 50 cubits in height. There were 25 gates in each side, opposite to the streets; and upon the walls, between the gates, were lofty towers. The sides of the river were faced with brick work as quays; and in the middle of the city was a bridge. This bridge was constructed of pillars set at 11 feet distance, and covered with stones laid horizontally; the roadway was 30 feet wide. Above the city two canals were cut from the Euphrates to convey the flood water to the Tigris, and to the west was an artificial lake 40 miles square, which received the water of the river while the quays were constructing; the lake was afterwards used for watering lands. At each end of the bridge was a palace; the old one at the east end was surrounded by three walls placed at a considerable distance from each other, the whole being 30 furlongs in circuit. The new one, by Nebuchadnezzar, was on the western side, and is said to have been eight miles in circuit, but this no doubt also included the royal gardens and parks. The walls were embellished with sculpture, particularly one piece representing Queen Semiramis on horseback, throwing her javelin at a leopard, while her husband Ninus is piercing a lion. The temple of Belus occupied one square. Near the old palace, in the middle, stood the ancient tower, the base of which was about 600 feet on each side, it consisted of eight towers placed on each other, and each 75 feet high: it diminished as it rose, and was ascended by means of an inclined plane, which passed eight times round the tower. In these towers were apartments supported by pillars: these were the temples, the uppermost being the most sacred. The top is said to have been an observatory. Nebuchadnezzar surround- this tower with buildings, so as to occupy a square of two furlongs on the side, and surrounded by a wall two miles and a half in circuit. There were several brazen gates, and many idols of gold, especially one of Belus 30 feet high, placed on a pedestal 50 feet high.

Alexander.

Inhabitants removed to people Seleucia.

Cyrus, about 540 B. C. took Babylon, by diverting the water of the Euphrates, and entering by the dry channel into the city. Susa being his capital, Babylon rapidly declined in grandeur; having revolted, it was again taken by a vile stratagem by Darius Hystaspes, who demolished its gates, and reduced the walls. His successor Xerxes, in 478 B. C. when returning from his inglorious expedition to Greece, plundered and demolished the tower of Belus. The enterprising Alexander, in 324 B. C. meant to have rebuilt it, and actually employed workmen to clear out the ruins, but his premature death interfered with this and many other splendid projects. In 294 B. C. it was almost exhausted of its inhabitants by Seleucus Nicanor to people his new city Seleucia. It suffered greatly by the neglect of the Parthian princes before the Christian æra; and in the 4th century, Jerome informs us, that, "its walls were employed by the Persian princes as an enclosure for wild beasts, preserved there for the chase."

Such has been the rise, progress, and termination of this singular city, where architecture was practised on a truly gigantic scale. Had the materials employed been granite, porphyry, or marble, instead of bricks, we should still, doubtless, with regard to mass, have had fragments worthy to be compared with those of Upper Egypt; but as it is, we are to remember, that the latter part of the period we have been contemplating, is distant 2400 years, and that the constructing and ornamenting of Asiatic cities, was governed by the vanity and caprice of despotic sovereigns, instead of the unvarying pursuits of a permanent independent priesthood.

Nineveh.

From the best authorities, it appears, that Nineveh resembled Babylon in form, extent, and population. Diodorus Siculus says it was 480 stadia in circuit, that its walls were 200 feet high, and that there were 1500 towers. Strabo admits, that it was larger than Babylon. It was taken by Arbaces and Belesis, 747 B. C.; and again by Astyages, 626 B. C. when it was totally ruined.

Susa.

The next imperial cities were Susa and Ecbatana. Susa was built or restored by Darius Hystaspes; it was an oblong of 120 stadia in circuit, and situated upon the river Uhlai, or Cutæus.

Ecbatana.

Ecbatana was built by Deioces, king of the Medes; it stood upon a gentle declivity, 12 stadia from the Mount Orontes; its circuit was 150 stadia; it was unwalled, but had a strong citadel or palace, encompassed by seven walls, each distinguished by a separate colour, and rising gradually above each other. Herodotus says, it was about the size of Athens. Some are of opinion, that the present Taurus is the same as Ecbatana, but there are now no vestiges of the famous citadel or palace. It is said by Sir John Chardin to have been, at the time of his visit, the second city in Persia, and at that time to contain 15,000 houses, 15,000 shops, 300 caravanserates, and 250 mosques; that the total population was 550,000, and that the piazzas exceeded those of Ispahan.

Persepolis.

Of all the ancient Persian cities, the ruins of Persepolis alone now exhibit to us a specimen of their palace architecture. It is situated in 30° 40′ N. latitude, and 84° E. longitude, in the province of Fars or Faristan, in a fertile plain about 40 leagues in length, and from 2 to 6 in breadth. There are, it is said, 880 villages in this plain, and 1500 in a circle 12 leagues round Persepolis.

Diodorus says, that Cambyses, after destroying the Egyptian temples, carried the spoils into Persia, and adorned the edifices he constructed by means of Egyptian workmen. But it is known that Cambyses died before he reached Persia, and therefore it is more probable these works may be attributed to his successors Darius and Xerxes; for Strabo states, that the kings of Persia, after decorating the palace of Susa, did the same to Persepolis and Pasargade.

No traces of the city.

Plate CLIII.

Three sides of the palace visible.

There are no vestiges of the city of Persepolis, but the extensive terraces, lofty columns, and Egyptian doorways of the palace, are singularly striking, (See Plate CLIII.) they are usually denominated the forty columns, but the traces of 205 were discovered by Le Brun, who spent three months in exploring, measuring, and delineating the ruins and sculptures. Of this superb building, the walls of three sides were then visible; the façade was 600 paces from north to south, and 300 from east to west. The 19 columns then standing were from 70 to 72 feet high, and 17 inches 7 nails in circumference. From the annexed Plates and the discussions under the Practice of Architecture, it will be seen, that these columns were different from the Egyptian: they appear too slender to support much weight, and therefore strengthen the probability of this being a summer palace, where temporary coverings were employed.

Sculpture.

Le Brun, after stating what is said by Diodorus Siculus Ptolemy of Alexandria, Strabo, Quintus Curtius, Stephanus, Ammianus Marcellinus, and Josephus, endeavours to prove, from the sculptures, that this was the palace of Persepolis, destroyed by Alexander 327 B. C. The dress and arms of the figures are partly Persian and partly

Median. The Persians offered horses to the sun, and oxen to the moon, as is shewn in the sculptured procession; here is also the tiara worn in the time of Cyrus, in the processions, where the principal lords were obliged to assist: (See *Xenophon.*) The umbrella was in use amongst the ancient Persians. The long robes, with foldings, is a Median dress.

Tombs of the kings.

Plate CLIII.

The tombs of the kings are found in one mountain to the south, and another to the north; the façade of the former is cut in the rock, and is ornamented with sculptures, Plate CLIII.; it is about 70 feet broad on the base; the part decorated with figures is about 40 feet broad, and as much in height; the rock extends beyond it on each side about 60 paces. The other tombs are similar to this. Le Brun found about 1300 figures of men and animals sculptured on these tombs; some of the men from 7.5 to 10.7 feet high; some had parasols or umbrellas over their heads; some were armed with lances; and many were combating lions. But for the particulars, we must refer to Plates CLIII. and CLIV., and the discussions under the Practice of Architecture.

Palmyra and Balbec.

Of the cities which rose to eminence in Persia and Syria under the Greek and Roman empires, the ruins of Palmyra and Balbec are best known to Europeans; but as their architecture is indisputably Roman, they will be noticed more properly when treating of the works of that great people.

Ispahan.

Ispahan, the present capital of Persia, is situated in the province of Irac, or Persia Proper, in 32° 25′ N. Lat. and 86° 40′ E. Long. Shah Abas, after the conquest of the kingdoms of Laz and Ormus, fixed his court there in 1620 and 1628. It is situated in an extensive plain, surrounded by mountains; the plain is watered by several rivers; of these, Zenderoud, after being joined by the Mahmood, passes by Ispahan, where it is crossed by three fine bridges; it is there about the breadth of the river Seine at Paris; some streets are broad and handsome, but many are narrow, crooked, and dirty; the public buildings are rather neat than magnificent. The great market-place and palace, which are 3-4ths of a league in circumference, and the buildings upon the bridges, make a good appearance: With regard to architectural construction, their external aspect points out distinctly the use of slender upright props, with flat and very slight coverings extended upon them, and projecting so as to protect those walking in the galleries from the sun.

Chinese architecture.

General remarks. Plates CLV. and CLVI.

These three countries, viz. Egypt, India, and Persia, as far as we know, comprehend all that is great and ingenious in the most ancient state of architecture. The countries to the north and west were without specimens of ancient art, and China possesses little which can establish a claim to architecture as a fine or ingenious art. The palace of Pekin presents only a large caravansera, with numerous courts and extensive galleries, having their trifling wooden posts highly japanned and gilt. The pagodas, Plate CLV. have each the appearance of tents piled upon each other; but in none of these structures is there to be found one feature expressive of great design or scientific skill. Through the richest parts of this great empire, which have lately been visited by Europeans, every private dwelling bespeaks poverty and an overstock of population; even their great wall, destitute of any claim to ingenuity, is only an instance of a numerous and timid people, terrified into the pitiful project of excluding, by means of a mass of earth, faced with masonry, their poorer and more warlike neighbours. If, therefore, this country, as has been asserted by an eminent writer, (Sir W. Jones), was originally a colony from India, this colony had not risen to that powerful state to enable them to adopt the sacred architecture of their parent country, before they were overrun by a people whose notions of building originated from the use of the tent, and whose habits led them to perform an infinite number of little things by almost individual independent exertions. Being situated at the eastern extremity of a continent, at a great distance, and, in many cases, separated by extensive deserts and vast ranges of mountains, from those western countries which afterwards became eminent for arts, or formidable by arms, China has long retained the same arts, nearly in the same degree of perfection.

Of Grecian Architecture.

Grecian architecture.

The next step in the history of architecture, leads us to consider it as practised in the Grecian states; and here, although during its early stages much uncertainty prevails, yet by the aid of ancient historians and scientific travellers of modern times, we are enabled to trace a tolerably connected view of the rise and progress of this school of the arts.

To conceive the Greeks totally ignorant of the state of architecture in Egypt and Persia at a period when those immediately adjacent empires had long existed in great splendour, had constructed edifices of the greatest magnificence, and were the countries from whence, if the Greeks were not originally colonies, they certainly very early derived the first rudiments of their knowledge, would be carrying credulity to an unwarrantable length. That the Greeks benefited by the architecture of Egypt and Persia, and even India, is rendered still more probable, by considering, that their early sages uniformly drew their information from these countries; that the commencement of the most rapid progress of architecture in Greece corresponds with the time of their connection with Egypt in the reign of Psammaticus; and that the pillars of the finest ancient edifices in each of those countries, in their shafts, capitals, and other ornaments, afford sufficient hints for a people less ingenious than the Greeks.

The Greeks received the elements of architecture from Egypt, Persia, &c.

But this singular people, situated in a rugged, and, in a great measure, insulated country, at the junction of Asia with Europe, and at no great distance from Africa, with the benefit of a fine climate, and unfettered freedom, appear to have collected, refined, and carried to a much higher degree of perfection, the knowledge and arts of those great countries to the east and south of them; and in what regards poetry, eloquence, painting, sculpture, and architecture, they produced in the course of a few centuries, specimens which succeeding generations have not been able to surpass.

which they refined and perfected.

Egypt had no wood.

Egypt had no wood, but abounded in mountains of granite, porphyry, and marble. These circumstances, and the extensive use which the earliest inhabitants made of natural and artificial caverns, must have led them to form their peculiar style of architecture.

Woods in Greece.

Greece, on the contrary, was possessed of forests, and the essential parts of their finest structures are evidently derived from the application of the materials which they furnished. The columns and entablatures correspond precisely with upright posts and horizontal beams of wood; and, above all, the pointed roof of their temples, which in Egypt and Persia had hitherto been flat, is peculiarly their own. In what regards decoration, the Greeks chiefly made use of the essential parts, and they bestowed their attention almost exclusively upon the external parts of the edifices.

The Greeks introduce the pointed roof.

General remarks.

These appear to be the general distinguishing features of Greek architecture; and, without excluding that people from the preceding labours of their neighbours in lesser points, it is evident that many essential parts are peculiarly their own; and scarcely had they attempted buildings of any considerable magnitude, when their judgment, skill, and taste, were displayed to a degree which placed the architecture of Egypt, Persia, and India, in the infancy of the arts. It was certainly greatly in favour of Greece, that, in process of time, fine marbles were employed; but, independent of the excellence of this material, there was more expression of mind in the formation of one statue by an eminent Greek sculptor, than in myriads of Egyptian hieroglyphics.

Of the Doric Order.

Doric order.

The first distinct character of the architecture of the states of Greece, has been denominated Doric, from the country in which it was invented. In the earliest specimens, the diameter of the pillars, in proportion to their height, bears a strong resemblance to those used in some of the Egyptian temples; but the triglyphs, metopes, and mutules, represent the disposition of wooden beams, and the ends of the rafters which compose the sloping roof.

Log-house a model for the Doric.

Plates CLVII. and CLVIII.

Conjectures respecting the Egyptian emigrants.

If we admit that the people amongst whom the Doric order took its rise, were colonies from Egypt or Phœnicia, dispossessing their more barbarous predecessors, and settling in a country abounding with forests, it is natural to expect, that, being at the time of their settlement possessed of a tolerable degree of information and skill, habitations similar to American log-houses would be constructed. This would at once furnish a correct model of the Doric order: and, if this was the case in private dwellings, a public building required only to be of increased dimensions, with some degree of decoration upon the essential parts; (see Plate CLVII. and CLVIII.) for which, as we have already observed, the Egyptian and Persian architecture furnished abundant hints. It may, however, be objected, that no trace of Egyptian mythology is to be found upon any work in Greece. In answer to this, it may be observed, that there are none upon the Egyptian pyramids; and besides, that, with respect to the causes of those emigrations to Greece, it cannot be reckoned an improbable conjecture, that the continued tyranny of the Egyptian priesthood, or kings, at last roused some bold innovator, who, rather than be controuled, removed, with a colony of similar characters, to Greece. If this is admitted as probable, we need not be surprised that the mythology and habits of the mother country were in a great measure changed; and, by comparing emigrants of this description, with those of a similar character in modern times, combining with these the local circumstances of those detached and intersected countries, and granting, (which history authorises), that various colonies, at separate times, settled in and formed the several states of Greece, we may easily conceive how such independent and turbulent characters were originally formed. But whether these speculations are admitted or denied, it is evident, that a building resembling a log-house has been the model of the Doric order; and it seems quite unnecessary to attempt to trace the art of building previous to that stage, since the habitations of all savages, even after they have obtained some degree of fixed residence, are uniformly found to be the cavern or the hut, according as their local situation is in a rocky or a wooded country.

Argolis, the cradle of the Greeks.

Doric order established at Argos,

and adopted in many temples. Plate CLVII.

dispositions of the columns;

its majesty.

The district of Argolis first received colonies who introduced civilization into Greece. It has been reckoned the cradle of the Greeks, the theatre of the events which distinguished their earliest annals, and the country which produced their first heroes and artists. It was, accordingly, in the temple of Juno at Argos, where the Doric order rose first to a marked eminence, and became the model for the magnificent edifices afterwards erected in the other cities, states, and islands. (*Vitruv.* b. iv. c. i. p. 68.) After the Doric order had been established in the temple of Juno at Argos, it was employed in the temple of Jupiter Nemeus, between Argos and Corinth; Jupiter Olympius, at Olympia in Elis; in a splendid triple portico in the city of Elis; and also in three temples in the same city, to Juno, Minerva, and Dindymene; at Eleusis, in the great temple to Ceres; in that of Minerva, at Sunium; and, above all, in the temple of Minerva Parthenon, (see Plate CLVII.); in the entrance to the Acropolis, and other public edifices, of great magnitude and splendour, at Athens. In many of the islands there were also temples of the Doric model: that of Apollo in the isle of Delos; Juno in Samos; Jupiter, Panellenius, Ægina, and Silenus, in Sicily; and innumerable in places of inferior note. Even in Ionia, it was employed in the temple of Apollo Panionius. Many of these edifices were of great magnitude. The temples of the Greeks were universally of an oblong form; in some, the porticos were at the ends only; in others, they were extended quite around the cell, some in single, others in double ranges; some were covered with roofs, others were left partly uncovered; and some of them were divided by ranges of pillars along the middle of the cell. The superstructure was placed upon a platform composed of three steps, which surrounded the whole edifice, and upon which the columns were all placed without bases. The number of columns were either 6 along the ends, and 13 along the sides, or 8 along the ends and 17 along the sides. (*Vitruv. Anacharsis*, Stuart's *Antiq. Athens*, *Ionian Antiq.*) When formed upon so large a scale, and the ranges of columns so distinctly insulated, the essential parts of the Doric order produced effects not to be exceeded for simplicity and majesty; even the imperfect fragments now remaining, appear to have far surpassed the expectations of persons well qualified to appreciate their merits. They were the chief embellishments of their cities; and their magnificent colonnades, by excluding the sun and rain, became the resort of the wealthy and idle, who associated for the purposes of business or pleasure; and also of those who delighted to engage in discussing the subjects of politics and philosophy.

its dimensions became more slender.

In the earliest specimens, the diameters of the Doric columns were very great in proportion to their height; that of the temple of Silenus, in Sicily, being only five diameters in height; but, in process of time, these relative dimensions were changed, and a considerably greater portion of delicacy introduced: The finest marbles were employed, and artists of the first talents not only formed the models of the edifice, and directed its execution, but also, under the strongest influence of rivalship and thirst of glory, they, with their own hands, clothed those edifices with sculptures, and enriched them with statues, expressive of more than mortal excellence.

This chaste and severe Doric style was, with very few exceptions, the only one employed in Greece or its European colonies in Sicily and Italy, until after the Macedonian conquest. (*Ionian Antiq.* vol. ii. Preface, p. 1.)

Of the Ionic Order.

Ionic order.

The Greek colonies which were planted in a part of the coast of Asia, named by them Ionia, being in possession of a rich country, with many cities well situated for commerce, became very populous and rich. Philosophy, science, and the arts, flourished there in so high a degree of perfection, that their claim to eminence has been reckoned to surpass that of any district of the mother country in the zenith of her glory, and they are even said to have finally adjusted and refined the proportions of the Doric order. See *Ionian Antiq.* Preface, vol. i. p. 3.

Plates CLVII. and CLIX.

Origin of the Ionic capital unknown;

supposed to be an imitation of rams horns,

and of curled bark;

where employed.

In Ionia, the temple of Apollo Panionius was built after the Doric manner; but that refined people, not satisfied with the simplicity of this order, invented another of a more delicate character, and named it after their own country, the Ionic. (See Plates CLVII. and CLIX.) They made the height of the column greater in proportion to its diameter than in the Doric; the capital was totally different in principle, the entablature was also changed in its members and proportions, and a base was added to the bottom of the column. Of the origin of this capital, we have no satisfactory account; Vitruvius, and later writers (who have all retailed precisely his relations,) reckon, that as the Doric was strong and masculine, the Ionians modelled their order with female delicacy, and that the volutes were taken from the curls of hair on each side of the face. It is difficult to conceive how the proportions of a Greek order of architecture could be taken from the human figure, to which it has no relation or resemblance; masculine and feminine have rather the air of figurative expressions, adopted by this lively people, in comparing these orders after they had been established. It has been, by others, with some degree of probability, alleged, that the shape arose from the custom of nailing rams horns upon the top of the posts. But the most simple and natural hint for the Ionic volute, which may be conceived as having fallen under the immediate notice of artists and workmen, seems to be the curling of the bark of a tree crushed down by a weight laid upon a rude upright post. The edifices constructed after this order were numerous and most magnificent. It was employed in the temple of Bacchus at Teos; Apollo at Miletus; Minerva at Priene and Tegea; and of Diana at Magnesia and Ephesus. It was likewise used in the temple of Minerva Polias in the Acropolis, in those of the Delphic Apollo and Æsculapius at Athens, and in a temple of Juno in Attica.

Temple of Diana at Ephesus.

That of Diana of Ephesus, the design of Ctesiphon the Cnosian, and his son Metagenes, (who wrote a treatise upon it,) is said to have been 425 feet in length, 220 in breadth, and 70 in height; it had a double portico all around the cell, erected by the contribution of all Asia. Xerxes, who destroyed all the other temples in his rout, spared this magnificent fabric. It was burnt by Herostratus during the night in which Alexander was born. It was rebuilt after a design of Dinocrates; Canachus the Sicyonian, a scholar of Polycletus the Argive, made the statue 124 years after Xerxes destroyed the first, and 365 before the Christian æra. See *Vitruv. Ionian Antiq.* vol. i. c. 3.

Of Diana at Magnesia.

Origin of the Pseudodipteros.

The temple of Diana at Magnesia was constructed under the direction of Hermogenes. He made the general dimensions the same as for the dipteros or double range of columns; but, in order to afford more space in the porticos, he omitted the inner range: By that means a clear space was left between the outer range and the wall of the cell, and he thereby established the Pseudodipteros. He wrote a treatise upon this temple and that of Teos, (*Ionian Antiq.* vol. i. c. 11.) Vitruvius speaks with great veneration of the talents of this architect.

Temple of Minerva at Tegea, by Scopas.

The temple of Minerva Ulea at Tegea, designed and erected under the direction of Scopas, was of singular construction: The peristyle which surrounded the temple was of the Ionic order, the cell was divided into three aisles by two rows of Doric columns, and over these were placed others of the Corinthian order. The sculpture upon the two pediments was by the hand of Scopas himself. Upon the one was represented the hunting of the wild boar of Caledon, where, among a great number of figures, were those of Hercules, Theseus, Pirothous, and Castor; upon the other, the subject was the combat of Achilles and Telephus. *Anacharsis*, vol. iii. p. 71.

Of the Corinthian Order.

Corinthian order,

Plate CLX.

invented by Callimachus.

Egypt and Persia afford hints of this order.

The artists of Grecia Proper, perceiving that, in the Ionic order, the severity of the Doric had been departed from, by one happy effort invented a third, which still much surpassed the Ionic in delicacy of proportion and richness of decorations: this was named the Corinthian order. (See Plate CLX. The merit of this invention is ascribed to Callimachus, an Athenian sculptor, who is said to have had the idea suggested to him, by observing Acanthus leaves growing around a basket which had been placed, with some favourite trinkets, upon the grave of a young Corinthian lady; the stalks which rose among the leaves having been formed into slender volutes by a square tyle which covered the basket. It is possible that a circumstance of this nature may have caught the fancy of a sculptor who was contemporary with Phidias, (Stuart's *Antiq. Athens*, Pref.) and who was doubtless, in that age of competition, alive to every thing which promised distinction in his profession. But, in the warmth of our devotion for the inspiration of Greek genius, we must not overlook the facts, that, in the pillars of several of the temples in Upper Egypt, whose shafts represent bundles of reeds or lotus bound together in several places by fillets, the capitals are formed by several rows of delicate leaves. (See *Denon.*) In the splendid ruins of Vellore in Hindostan, the capitals are also composed of similar ornaments; and it is likewise well known, that the Persians, at their great festivals, were in the habit of decorating with flowers the tops of the pillars which formed their public apartments: It is therefore not improbable that these circumstances, after so much intercourse with those countries, might have suggested ideas to Callimachus, which enabled him to surpass the capital of Ionia. The whole fabric of the Corinthian order is composed with a great delicacy of taste. It is admirably fitted for the most highly ornamented states of architecture, and is strongly expressive of the refinement and excellence to which the Greeks had carried their taste and skill in architecture and sculpture.

The Greeks having invented and established three orders, with each a separate character, calculated for edifices, gradually ascending from the most simple to those which were highly ornamented, completed a distinct and perfect school of architecture, to which there remained nothing to be added.

Sir W. Chambers despised the Greek architecture.

From the account given of the various edifices constructed after each order, it is evident, that the passion for magnificent buildings and fine sculpture was carried to a great height. It so far exceeded the apparent extent of the means of the Greek states, that an eminent architect and architectural writer of our own country, (Sir W. Chambers,) disputed their existence. Unfortunately for his speculations, the labours of late scientific travellers, perfectly qualified, and of undoubted veracity, have furnished correct drawings of many remains, which fully justify the accounts of former times, and are highly deserving the encomiums which have been bestowed upon them.

Competitions of the states of Greece.

Value attached to architecture.

After the defeat of Xerxes, the Greeks obtained the full possession of liberty. They applied with great success to the cultivation of philosophy, science, and arts. They became not only sensible, but vain, of their decided superiority over the Egyptians and Persians; and as each state endeavoured to maintain a perfect independence, and many attempting to acquire a superior influence, it is very conceivable that their jealousy, rivalship, and continual contention, would strongly influence the arts of architecture and sculpture; while the insatiable rage for distinction, which pervaded all orders of men, animated, to a particular degree, those artists, who, by their works in architecture and sculpture, expected, and frequently acquired the applause of their countrymen and posterity. The value attached to works of this nature, may be judged of from the city of Ephesus refusing to suffer the temple of Diana to be inscribed with the name of Alexander the Great, although this prince offered to purchase that honour by defraying the whole expence attending its erection; from the Athenians rejecting a like offer from Pericles, with regard to the splendid and extensive edifices with which he had ornamented Athens. (*Ionian Antiq.* vol. i. c. 111.); and from the city of Gnidia refusing to part with one statue, (the Venus of Praxiteles,) although King Nicomedes proposed to free them from tribute if they complied with his request.

Temples erected at the common expence of all Greece.

The art extended to the Greek colonies.

Temples appear to have been the only property which these turbulent states could agree to have in common, and this union enabled them to construct edifices of great magnitude and splendour. They had many of this description, built and maintained at the expence of confederated states, and even of all Greece: Such were those at Delphi, Delos, Ephesus, Olympia, Eryx, &c. These temples had territorial revenues, and were enriched by private donations. Being secured by the laws of war, they were banks wherein states, and even individuals, deposited treasure; and, instead of the priesthood, the management was vested in the magistrates, (*Ionian Antiq.* vol. ii. Pref. p. x.) The Greek architecture prevailed in the countries where that people extended their influence along the coast of Asia. Alexander and his successors introduced it into Egypt, and most probably in the cities he built on his route to India. To the westward it spread as far as Sicily, Italy, and the south of France.

Besides temples, the Greeks constructed many other public edifices of great magnificence: These were the Forum, Stadium, Theatre, and Tomb. But as these require a full and extensive discussion, they will be taken up under their several appellations.

Of private dwellings.

Plate CLXI.

The private dwellings of the Greeks were generally mean; but, from the description preserved by Vitruvius, a drawing of which, taken from Palladio, is given in Plate CLXI. it appears, that the villas of some of the principal men were extensive and highly decorated; and, by admitting strangers to occupy separate complete suites of apartments, they were contrived for a very perfect intercourse of society. That this was required in Attica, is easily to be conceived from the great number of strangers which, for many years, resorted to Athens; and they would also be necessary in those countries which were adjacent to the Amphictyonic temples. Besides these causes, there can be no doubt but, in the districts which carried on mercantile transactions, such as Athens, and Corinth in Grecia Proper, almost all the cities of Ionia, of Asia, and also among the islands to the westward of Greece, that the accumulation of wealth would produce effects similar to what takes place in other countries, and would distinguish the habitations of its possessors.

Period of its most rapid progress in Greece.

The Greeks appear to have made the greatest progress, and constructed the most magnificent of their edifices, during a period of time commencing with the age of Solon and Pythagoras, and ending with that of Pericles, being about 300 years. It is worthy of remark, that the period at which architecture began to flourish most in Greece, corresponds precisely with the reign of Psammaticus in Egypt, who encouraged and benefited by the assistance of the Ionian and Carian Greeks, and induced them to establish colonies upon the Nile. See *Herod.* b. ii. *Ionian Antiq.* vol. ii. chap. v. p. 19.

The art declined after the time of Alexander.

After the time of Alexander, the Greek manners were blended with those of Asia. The sublime spirit of independence, and high notions of superiority, which had hitherto exalted their characters, and rendered them capable of such unparalleled exertions, if not quite subdued, was deeply contaminated; and although they long continued to be the instructors of their Roman conquerors, it is from this æra that the declension of the pure Greek architecture may be dated.

OF ROMAN ARCHITECTURE.

Roman architecture.

Spoils of Sicily.

THE Romans, through every period of their history, from the first inconsiderable efforts of their infant tribes, to the complete establishment of a most extensive empire, were continually engaged in foreign or domestic wars. The principle of their government being at first of a popular cast, it was to military skill, and a simple but impressive eloquence, that their whole attention was devoted, and upon which their national character was formed. Until the state had reached the zenith of its glory, by subjecting all the nations, including Britain, to the west, Macedonia and a part of Persia to the east, and the northern parts of Africa to the south, they preserved the utmost simplicity of manners, remained in a great measure ignorant of what are denominated the fine arts, and, of course, set no value upon, but rather despised them. All to the north and west of Italy being in a barbarous and rude state, it was not until the Romans had extended their conquests over the colonies of Greece, Greece itself, and a part of Asia, that they had an opportunity of becoming acquainted with fine architecture, sculpture, and paintings. Plutarch relates, that Marcellus brought the spoils of Sicily, consisting, in part, of the most valuable statues and paintings of Syracuse, on purpose to adorn his triumph, and ornament the city of Rome, which before his time had never known any curiosity of this kind; and he adds, that Marcellus took merit to himself for being the first who taught the Romans to admire the exquisite performances of Greece.

Architecture rose hastily to extravagance.

But when the most formidable rival states had been destroyed or subjected, the wealth which all at once came into the possession of the Romans affected their manners; and having not only the productions of Grecian genius, but the artists themselves, within their power, the transition was into the extreme of luxury and splendour.

The art rose gradually in Greece.

In Greece, the arts rose from small beginnings, from the unremitting efforts of rival states and artists; they were, therefore, natives of the country, while the manners of the inhabitants were polished, but natural: but to the Romans who merely acquired them by power; they were emblems of superiority lavishly and indiscriminately employed. It was evidently under this impression that the Romans greedily seized the Corinthian, being the most gorgeous of the Greek orders, and employed it almost exclusively in all their public edifices, and private dwellings.

But, even for some time after Marcellus had introduced specimens of Grecian art, and out of the spoils of Sicily built and embellished the Temple of Virtue and Honour, it does not appear that much impression had been made upon the Roman people; and although, about forty years afterwards, at the triumphs which Paulus Emilius obtained for the conquest of Macedonia, it is said the first day was scarcely sufficient to exhibit the images, paintings, and colossal statues, carried in 250 chariots, (*Plutarch*,) yet it was not until after the return of Sylla from the Mithridatic war, (which was 120 years after the triumph of Marcellus,) that specimens of fine buildings can be distinguished. It was only fifty years previous to this that an edifice of marble was first erected at Rome; but, in the consulship of Quintius Catullus, it is said 100 marble temples were erected. Pompey erected a theatre, and Julius Cæsar the temple of Apollo, the porticos, library, and mausoleum. *Ionian Antiquities*.

One hundred marble temples in Rome.

From this period, the progress in luxury and extravagance was rapid: In a few years, the villas of the principal men (see Plate CLXI.) were extensive and highly decorated: Those of Lucullus surpassed even eastern magnificence.

Plate CLXI.

The magnificent and politic Augustus, confirmed in power, and with the command of unbounded wealth, exceeded his predecessors so far, as to boast, that he found Rome composed of brick, and changed it to marble. The following are the principal edifices erected during his reign: The temple and forum of Mars the Avenger, the temple of Jupiter Tonans in the capitol, of Apollo Palatine, with public libraries, the portico and basilicæ of Caius and Luvius, and the porticos of Livia and Octavia; (see *Suet.* c. 28.); and besides these,

Edifices by Augustus.

In the Year of Rome

720. The curia, schools, a noble portico round the temple of Jupiter and Juno, with a library adjoining.
723. Statilius Taurus finished an amphitheatre at his own expence.
724. The temple of Minerva, called Chalcidicos, was built of brass.
725. Augustus built a mausoleum for himself and family.
726. Agrippa, the friend and son-in-law of Augustus, built, or rather altered and embellished, the Pantheon. See Plate CLXII.
727. Agrippa dedicated the septa, for containing the comitia tributa.
728. He erected the portico of Neptune, and near it built the temple and basilicæ of that deity; he added the magnificent portico to the pantheon, and behind that edifice built the thermæ for exercises in the Lacedemonian manner.
730. He constructed the great theatre of Marcellus, to the memory of Marcellus, son of Octavia, sister to Augustus.
734. He brought the aqua virginis to Rome, by an aqueduct fourteen miles in length.
748. He presented to the sun the great obelisk of Sesostris, brought by him to Rome.

Pantheon. Plate CLXII.

Temple of Faunus. Plate CLXIII.

During the reign of Claudius, the very curious temple of Faunus (see Plate CLXIII.) was built upon the Celian Mount. It was of a circular form, and had internally two rows of Ionic columns, with arches springing immediately from the capitals. The upper windows had each a column in the middle, with arches also springing from the capitals; and these two arches were inclosed by a semicircular arch, which had its springing upon the jambs of the window, and, rising higher, left a considerable space between it and the two before-mentioned small arches; in which space there was a circular opening. This is particularly noticed as an early and distinct type of what was afterwards named Saxon, Norman, and Gothic. See Desgodetz' *Ancient Rome*.

In Nero's time, the city having been destroyed by fire, was rebuilt with more regularity and splendour. The accounts of the extent and splendour of his golden house exceed credibility. The strict œconomy of Vespasian enabled him to construct the temples of Peace (see Plate CLXIV.), and the Colisæum, two of the greatest and most magnificent edifices at Rome, the latter being 580 feet in length, and 470 in breadth. The elliptical amphitheatre of Titus was upon an equally large scale, being 564 feet in length, 467 in breadth, founded on 80 arches, and rising with five successive orders of architecture to the height of 140 feet; the outside incrusted with marble, and decorated with statues; having 60 rows of seats, 64 vomitories, and calculated to contain 80,000 persons at one time: The extensive baths of Titus were equally splendid. During the time of Domitian, the temples of Jupiter Capitolinus and Minerva were erected. The excellent Nerva contributed to adorn Greece, by his liberal conduct to Herodes Atticus, a descendant of Cimon and Miltiades, who having discovered a vast treasure buried under an old house, and conscientiously informed the emperor that it was too much for the use of a private man, was nobly told, "to abuse it then, for it was his own." Herodes having obtained for his son Herod the prefectorship of the free cities of Asia, this young magistrate immediately employed his treasure in architectural improvements. He, in four years, built the stadium at Athens, 600 feet in length, all of white marble; also a theatre, which he dedicated to his wife Regilla. He restored the odeum of Pericles; he built a temple to Neptune in the isthmus, a theatre at Corinth, a stadium at Delphi, and a bath at Thermopylæ. At Troas he supplied the city with water at a great expence; he built an aqueduct at Canusium in Italy; and the people of Epirus, Thessaly, Eubœa, Bœtica, and Peloponnesus, also partook of his bounty. The forum of Trajan (by Adrian) was expressive of his great character: it was of a quadrangular form, surrounded by colonnaded porticos, and entered by four triumphal arches. In the centre stood his celebrated column, 140 feet in height, where the principal actions of his reign were represented in exquisite sculpture, and have remained the truest chronicle of his time. His successor Adrian seemed to have journeyed over the provinces, in order to build and restore cities and public edifices: He built the beautiful city of Antinopolis in Egypt. At Athens, he completed the great temple of Jupiter Olympius, which had 128 Corinthian columns, each 60 feet high; restored the walls and gates, and by inscription claimed the city as his. He supplied the city of Corinth with water. He was himself an architect, so zealous and vain, that the great Apollodorus fell a victim to an unguarded reflection upon his plan for the temple to Rome and Virtue. That his taste was open to just criticism, is rendered probable from the whim of his having all the styles then known introduced in his famous villa. He likewise built the great wall across Britain, between Newcastle and Carlisle.

Temples of Peace and the Colisæum. Plate CLXIV.

Herodes Atticus.

Stadium at Athens.

Forum and column of Trajan.

Temple of Jupiter Olympius at Athens.

With the continued influx of wealth from the numer-

Architecture extended beyond propriety.

ous, rich, and extensive provinces, the rage for magnificence kept pace; and public and private buildings increased much beyond the bounds of propriety. To debauch the people, public shows had been introduced, and theatres of vast magnitude constructed; habits of luxury required superb edifices for exercise and bathing; the forums were much increased in size and splendour; the single column had been employed as a recording monument; and the introduction of the arch had created many new structures, especially the triumphal arch and the aqueduct.

Its progress in the provinces.

This rage for building was not confined to Italy, but extended over every province of the empire. It appeared the most effectual way in which the different emperors, governors, and commanders, could gratify their vanity, and establish their authority; and their rapid succession led to an increase of the number in every quarter, from Palmyra and Balbec in the east, (where their architectural works were splendid and vast,) to the remote province of Britain in the west; but after the time of the Antonines, the people became vitiated, all dignity of character disappeared, and every thing proceeded from one excess to another without taste or arrangement.

Theodosius.

Justinian.

Their architecture, which never was pure, had degenerated into extravagance, and was overloaded with gorgeous ornaments. The talents of Dioclesian could neither reform the empire nor its architecture. He resigned the government of the former, and, in his palaces and baths, left specimens of the degenerate state of the latter. From this period architecture shared the fate of the empire, and, excepting some solitary instances in the reigns of Theodosius and Justinian, there is nothing deserving of attention; though, in order to preserve some idea of the style of those times, and establish a connection with a new school of architecture which succeeded, or rather for a considerable time interrupted the progress of the Roman, it is necessary to mention, that the third church built by Constantine was that of St Paul, on the road to Ostia; of which, the 40 columns enclosing the great aisle, 24 of blue and white marble were taken from the mausoleum of Adrian; that the church of St Paul, without the gates of Rome, was erected under Theodosius; and that St Sophia at Constantinople, was erected under Justinian. See Plate CLXXIII.

Plate CLXXIII.

Romans indebted to the Greeks.

The Romans were so much indebted to the Greeks for all that relates to architecture and sculpture, that they have little claim to any original ideas upon those subjects. Being found in so perfect a state as to repress all thoughts of rivalship, the Romans were contented to plunder and imitate. In the theatre of Marcellus and in the Coliseum, the Doric and Ionic were both introduced, but, with a very few exceptions, the Corinthian order only was employed by the Romans; and, as if not left by the Greeks sufficiently expressive of riches and magnificence, they loaded every member with ornaments unknown to the inventors. They united the Ionic and Corinthian into an order they named the *Composite*, and stripping the Doric of its finest features, they formed their Tuscan. When the particular members could receive no more ornaments, they had recourse to varying the outlines of their structures into every shape which could be produced by the union of circles or triangles. See Montfaucon's *Antiq.* vol. iii.

The arch introduced by the Romans.

To one important feature in architecture, the Romans appear to have an indubitable claim, that is the arch. The ancient Egyptians, Persians, and Hindoos, were entirely ignorant of its construction; and in no instance have the Greeks, previous to the Roman conquest, made use of arches, either in the external or internal faces of their buildings. It has been said, that arches over drains have been observed in the ancient temple of the sun at Athens, and that of Apollo at Didymus. If that were clearly ascertained, it would determine the merit of the mere invention to the Greeks; but it is evident, that the people never considered the arch of any importance as an external feature, nor were aware of the advantages which might be derived, by extending it over considerable openings, for in no instance have they in this manner employed it; and, notwithstanding the splendid and expensive works of Pericles, it was left for the Romans to construct a stone arch over the small river Cephisus, upon the great road to Athens. If, therefore, we should not be fully justified in attributing to the Romans the merit of the first invention, they assuredly had that of introducing arches into general and extensive use, and, by this means, creating a species of architecture unknown to the Greeks. The arch in their hands, was employed in extensive vaultings and domes, in triumphal arches, bridges over rivers, and in aqueducts for conveying water to cities. Thus far the arch was an important acquisition in the building art; but not satisfied with this, they hastened to introduce it in façades of Greek architecture, the distinguishing features of which being straight lines, the circular outlines of the arch were discordant, and distracted the mind between a style formed by the employment of timber beams, and another which could only be composed by a number of separate stones, placed in a position very different from that in which timber was used. This therefore became a glaring defect in the Roman architecture, and distinguished it widely from the simplicity of the Grecian.

Plates CLXII. CLXIII. CLXIV.

Dioclesian.

The specimens, exhibited in Plates CLXII. CLXIII. and CLXIV. will shew in what manner the Roman style was, at various periods, employed in public and private buildings. We shall therefore conclude this outline of its history, by observing that the power, wealth, and vanity of the Romans, led them to increase the number, magnitude, and decorations of their edifices to a degree almost incredible. The dexterity of execution in the pantheon, Trajan's column, the palace and baths of Dioclesian, and the triumphal arches, are evidence how well qualified their workmen were, at all those periods, of bringing the particular parts to any degree of perfection; but the directing mind was from the beginning deficient, and constantly became more depraved. The Greek style, which had been polluted in its introduction to Italy, had its forms at last so distorted and overwhelmed with injudicious ornaments, that scarcely any resemblance was left to distinguish its origin.

OF GOTHIC ARCHITECTURE.

Gothic architecture.

This name has been given to a school of architecture very different from either the Greek or Roman. Its origin has perhaps hitherto hardly been satisfactorily ascertained, but it certainly continued till the sixteenth century, when it was supplanted by the revival of the Roman style. It was only at the time of its extirpation that the appellation of Gothic was applied, in token of the contempt in which it was held by the school of Palladio in Italy, and Jones in England.

The fate of this style of architecture has been as singular as its principles of construction. It was, during a few centuries, practised over most of Europe with a degree of ardour, and to an extent which rendered its effects truly magical. From the zenith of its glory it was, by a very rapid transition, reduced to the state of degradation we have just alluded to.

After the expiration of about two centuries, men of science have again begun to discover the excellence of its principles, and men of taste to perceive the beauty of its forms. These violent transitions have led to much investigation and discussion, by persons well qualified for the task, such as Wren, Walpole, Gray, Warton, Wilkins, Carter, Bentham, Grose, Murphy, Knight, Dallaway, Whittington, Milner, and Sir James Hall.

Writers.

Various opinions as to origin.

One opinion is, that the pointed arch, and most of the delicate features of Gothic architecture, were furnished by the Saracens and Moors; a second finds, that the changes took place by the gradual deviation from the Roman manner, and that most of the features have arisen from the whim of Italian architects; a third ascribes the merit of the finest Gothic almost exclusively to the gradual changes introduced by the architects of England; while Sir James Hall has, with much taste and ingenuity, shewn how this style may have originated in a way totally independent of any other mode of architecture. Under these circumstances, we shall first endeavour to give a cursory but connected view of the progress of this architecture in Europe, from the time of the decline of the Roman empire to the 16th century; and then make such general observations as seem calculated to enable the reader to form his own judgment. We conceive this of sufficient importance to deserve his serious attention. It is a proof, that even where an art has been brought to a perfection, as in the case of Greek architecture, which seemed to preclude all farther improvement, yet a change of circumstances will produce another mode totally different, but equally perfect; and it is incontrovertible evidence, that the boundaries of human ingenuity are not to be easily limited.

Observation.

Roman architecture declined in the time of Dioclesian.

From the time of Vespasian, the Roman architecture began to be less pure. During the reign of Trajan it had considerably declined; and, in the splendid edifices of Dioclesian, forms had been introduced (Adam's *Spalatro*) not only foreign to the best style, but sufficiently different to afford hints for some features of the Gothic; such as arches springing from the top of capitals, of columns without any intervening entablature, and consols supported by figures projecting from the wall.

Gothic architecture employed in ecclesiastical edifices.

Gothic architecture having been employed almost exclusively in ecclesiastical edifices, this investigation must of course be directed chiefly to buildings of this description. The oldest Christian church now existing is considered to be that of St Paul, which was built by Constantine without the gates of Rome. This is also the earliest instance of a Christian church, in which the arches are raised upon round columns instead of square piers. Gibbon says, that the palace of Theodosius affords the oldest specimens of the Gothic; so that, coeval with the incursions of the Goths, the Roman architecture had been almost completely changed. The confusion which ensued towards the final extinction of the empire, led almost to the total neglect of the arts. The consequences of which, were the ignorance and incapacity of artists and workmen. These evils had also, by the incursions of the Goths and Huns, been spread over all Greece; and the effects upon the arts were manifest, from the failures and clumsiness of the best Greek architects. Justinian was able to select artists to construct his great church of St Sophia at Constantinople.

St Sophia at Constantinople.

Ancient basilicæ used or imitated.

At the time Constantine established Christianity, many of the basilicæ, or courts of justice, in the great cities of the empire, were converted into Christian churches, and being convenient for the accommodation of great assemblies, the new churches were built in the same form. This form was oblong, and had pillars within the walls of the covered cells, thereby dividing the whole breadth into three or four aisles. The principal entrance was at the west end; and the east end, where the tribunal was placed, was of a circular form. See Bentham *on Saxon Churches*.

Here, then, we find established the oblong form, with the space between the walls, divided by two rows of columns into three aisles. Upon the columns, arches are immediately erected in a connected range, to receive an upper wall which supports the roof. The chief entrance is also at the west end, and the east end is of a circular shape. An addition was made, which completed the Latin cross, and perfected the ground plan of a Christian church. The remains of ancient edifices, part of which were converted into churches, had still some influence in guiding the workmen of that age in their clumsy operations. They had preserved the principles and habit of arching vaults, especially the kind which is now denominated groins. They are formed by two arches intersecting each other at right angles, and, in many instances, springing from four points only. By this means, the diagonal lines formed by the intersection of the two arches, cross each other at the centre of the vault. It is of importance to notice this circumstance, because it afterwards became one of the principal features of the Gothic style.

Latin cross introduced.

Groin arches.

Rome being at the head of the Christian church, and for several ages possessing unbounded influence over all the rest of Europe, created a great intercourse, and afforded the ecclesiastical dignitaries ample opportunities of becoming early acquainted with the forms of the Italian churches. Their zeal and vanity introduced similar edifices into the several countries where they resided, and, through their means, the rage for building churches in a short time became general and excessive.

Dignitaries travelled to Rome.

Church building became extravagant.

This ecclesiastical architecture, drawn from the same source, and diffused through the several countries of Europe by the same description of characters, a general resemblance was preserved; yet the architecture of each country in this, as in other matters, from a variety of local circumstances, soon came to be distinguished by peculiar features. That of Italy retained the greatest resemblance to the Roman manner, and was seldom overloaded with ornaments. In the northern countries, the decorations were more redundant. In all of them, the attention was bestowed chiefly upon the western façade. At Pisa, Orvietto, and Sienna, in Italy, circular arcades and porticos are frequent. Some are composed of columns, taken from Roman works, and others imperfect imitations. In Spain, the architecture was strong and massive in its outlines, but decorated with minute ornaments of great delicacy, borrowed from the Moors. See Dallaway's *Observations*, pp. 2—6.

In Italy, the resemblance to Roman architecture preserved.

Western façade.

During the reign of Charlemagne, many magnificent churches were erected; and the extent of his dominions served to give some degree of regularity to the operations of architecture. This, especially in France, formed no inconsiderable æra. He is even said to have introduced it into that country; and it is certain that the cathedral of Rheims was erected during the reign of his successor in 875.

Charlemagne.

Crusades.

The most remarkable æra in the history of this school of architecture, was the crusades to the Holy Land. This apparent frenzy and delusion, which threatened to unpeople Europe, and overwhelm Asia, and which was actually productive of so much bloodshed and misery, had also the effect of introducing into the countries of the west, all the knowledge and arts collected from the east and south, into a district bounded by Greece and Palestine, and which, from the contentions of the Turks, Saracens, and the remnants of the Western empire, seemed on the point of extermination even from thence, and being of course lost to mankind. But the intercourse of 174 years, taught the rude warriors of Christendom the benefits of more polished manners, and made them acquainted with the improvements and arts of those eastern countries.

In those days of religious zeal, it cannot be doubted, that every thing which related to the improvements in the forms and decoration of ecclesiastical buildings, would be carefully attended to, by the prelates from different countries, who were connected with the several expeditions; and that they would, on their return home, endeavour to introduce their newly acquired information. See Felib. *Rec. Hist.* p. 165.

Fraternity of free masons.

Dionysiacs.

During the Crusades, another circumstance took place, which also contributed much to the perfection of their ecclesiastical buildings. Some Greek refugees, Italians, French, German, and Flemings, united into a fraternity of builders, and procured papal bulls and particular privileges. They assumed the name of free masons, and travelled from one nation to another, where their services were required. Their government was regular. Adjacent to the building which was to be erected, they constructed a camp of huts; a surveyor governed in chief, and every tenth man, called a warden, overlooked nine. (Wren's *Parentalia.*) This establishment, similar to the Dionysiacs of Ionia, upon whose model it was probably formed by the Greek refugees, was the means of creating great dexterity in the workmen, and of making the surveyors become perfectly well acquainted with every circumstance which related to the plans and decorations. From the different national styles which were formed and closely adhered to, it is probable that the ecclesiastics furnished the designs; because if the surveyors had done so, the same plans would have been repeated in the several countries where they were employed. Still it was of the first importance, to have men who understood plans, and workmen who were familiar with all the minutiæ of execution. See Free Masonry.

Italy.

Germany.

France.

Under all these circumstances, ecclesiastical buildings of great splendour were soon erected in the several kingdoms and states upon the Continent. In Italy, at Florence, Venice, Pisa, Sienna, Orvietto; in Germany, and amongst the Flemings, at Vienna, Strasburgh, Nuremberg, Antwerp, Ghent, and Brussels; and in France, at Rheims, St Denis, Amiens, Notre Dame, Verdun, Laon, Lezoux, Chartres, Rouen, and Seez, were very early and splendid specimens.

Campanile towers separate.

Mixture of styles.

In Italy, the nearest resemblance to the Roman manner, such as circular porticos and arcades, was preserved, but exuberance of decoration seldom occurs; the western façade engrossed the chief attention. Upon the centre of the transepts, cupolas were placed, and the campanile towers were always separate buildings. There are no spires in Italy, but the towers of Florence and Venice are slender, lofty, and beautiful. In the Baptista of Pisa, which was erected in 1152, the lower Greek manner is mixed with the German Gothic; in it are Corinthian pillars, circular arches, Gothic pinnacles, sharp pediments, enriched with foliage, and terminated with a trefoil. Such instances of Gothic features, were not common in France before 1220, at St Denis.

Profusion of decorations.

In France and Germany, the architects have also exhausted all their genius upon western façades, and in many of them have produced very magnificent and striking effects; but they much exceeded the Italian structures in profusion of decorations. Here numerous pointed and sculptured pediments, niches, statues, and canopies, were lavishly distributed; in many of them, one circular window occupied the space between two towers richly ornamented with clustered pinnacles, and in several of them were very lofty spires. At St Stephens, Vienna, and Strasburg in Germany, and Rouen, Constance, and Bayeux in France, the spires are just a continuation of the tower diminishing from its base.

Spires pyramidal.

Elements of fine church architecture.

To compose a perfect church, a French critic of Gothic architecture proposes to adopt the portal and west front of Rheims, the nave of Amiens, the choir of Beauvoirs, and the spire of Chartres. See Dallaway *Ob. on English Architecture.*

Of Gothic Architecture in Britain.

Britain.

Having given a general view of the most distinguishing æras and leading features of Gothic architecture upon the continent, we shall proceed to consider its progress in England, whose claim to the most perfect style of this school is generally admitted. In doing this, the learned and masterly investigations of the before mentioned authors, will enable us to trace a regular and connected progress; and we shall, for the sake of perspicuity, be as minute as the nature of our work will admit.

Agricola constructed temples.

Claudius.

When Agricola had subdued the northern parts of the island, he endeavoured to instruct and civilize the inhabitants. By means of the artificers attached to the army, many Roman edifices were constructed, and the numerous remains of temples and baths which have been discovered, are evidences of both public and private structures having been carried to a very considerable degree of perfection. This it was natural to expect during a residence of 400 years. The stone dug up at Chichester, which records a temple dedicated to Minerva by one of the companies of workmen, shows, that such buildings were executed long previous to Agricola, upon Claudius having reduced the southern parts of the kingdom, and probably soon after the temple to Claudius at Malden, to Minerva at Bath, and to Jupiter and Diana at London, were erected. See *Ornaments of Churches considered.*

Twenty-eight Roman cities built in England.

Hume relates, that during the dominion of the Romans, 28 considerable cities had been built, besides a great number of villages and country seats.

The Romans had, it appears, made very little progress in the instruction or civilization of the inhabitants; their subjection had been so complete, and their condition rendered so servile, as totally to annihilate their spirit, and debase their character; so that when the Romans withdrew from the island, the knowledge and practice of the arts were extinguished, and the inhabitants relapsed into helpless barbarism.

Whithorn in Galloway, 448 A. D.

Bingham (B. viii. p. 10.) says, that about the year 448, Bishop Ninian of Glasgow built an episcopal church on the confines of England, at Whithorn in Galloway, which was probably the labour of Roman workmen.

City of Canterbury.

As the Romans remained in Britain 88 years after the death of Constantine, it is, considering his zeal, to be expected, that some Christian churches were, during this time, erected; accordingly Bede mentions, that two were built in the city of Canterbury, one of which, on the east side of the city, was dedicated to St Martin, and given by Ethelbert, after his conversion, to St Augustin. See Wharton's *Essays.*

During the period in which the Saxons subdued, or extirpated, the antient Britons, and established themselves in England, a dreadful scene of devastation took place; the Roman cities and structures were wholly destroyed, and scarcely a vestige of their improvements was suffered to remain. But in the course of 100 years from the de-

First St Paul's, London.
St Peter's, York.
Weremouth.
Rippon.
Hexham.
Ely.

parture of the Romans, when King Ethelbert was converted to Christianity by St Augustine, the zeal for erecting ecclesiastical buildings took place. He founded the first St Paul's in London, and St Andrew's in Rochester. In 627, Edwin founded St Peter's in York, which was built of hewn stone, with spacious porticos. The Abbot Biscopius went over to France to procure workmen to build after the Roman manner; on his return he built St Peter's church in the monastery at Weremouth. In about a century after the conversion of Ethelbert, Wilifred, bishop of York, brought over eminent builders and artists from Rome, Italy, and France; he glazed the windows of York cathedral, and built the conventual church of Rippon in Yorkshire; which Edius says, he raised with hewn stone to a great height, and supported by various kinds of pillars and porticos. But his most sumptuous edifice was the cathedral church of Hexham in Northumberland. Richard, prior of Hexham, in whose time, 1180, it was standing, says, "That the foundations of this church were laid deep in the earth for the crypts and oratories and passages leading to them, which were then with equal exactness contrived and built under ground. The walls, which were of great length, and raised to an immense height, and divided into three stories or tiers, he supported by square and various kinds of well polished columns; and the arch of the sanctuary he decorated with historical representations, imagery, and various figures in relief carved in stone, and painted with a most agreeable variety of colours. The body of the church he encompassed about with aisles and porticos, which both above and below he divided with great and inexpressible art by partition walls and winding stairs; within the staircase, and above them, he caused flights of steps and galleries and passages leading from them, both for ascending and descending, to be so artfully disposed, that multitudes of people might be there, and go quite round the church without being seen by any one below in the nave. Moreover, in the several divisions of the porticos or aisles, both above and below, he erected many most beautiful and private oratories of exquisite workmanship; and in them he caused to be placed altars in honour of the blessed Virgin, St Michael, St John the Baptist, and the holy apostles, martyrs, confessors, and virgins, with all decent and proper furniture to each of them. It appeared, that of all the nine monasteries over which that venerable bishop presided, and of all others throughout England, this church of St Andrew in Hexham was the most elegant and sumptuous, and that its equal was not to be met with on this side the Alps." Wilifred gave great encouragement to skilful builders and eminent artists; he was himself well skilled, and was the chief director, in concert with those excellent masters he had brought from Rome; and it is probable, that the church and monastery of Ely, founded by St Etheldrida, were built under his directions; as we are informed by Ely the historian, that he spent a considerable time with her settling the economy of the convent. The connection with Rome continued to increase, as did the power and influence of the clergy, as well as their zeal for erecting ecclesiastical buildings.

Croyland.
York rebuilt.
Alcuin.
Alfred.
Old abbey of Westminster.

In 716, Croyland Abbey in Lincolnshire was founded by Ethelbald. In 767, Archbishop Albert rebuilt St Peter's of York. His first employment was in the capacity of master of the celebrated school of York, where he taught grammar, rhetoric, astronomy, natural philosophy, and divinity. He afterwards visited Rome, and many of the most eminent seats of learning on the Continent. On his return he was made Archbishop, and finding his church in a ruinous condition, he took it wholly down, and rebuilt it in a most sumptuous manner; his architects were Eanbald and the famous Alcuin, two of his own church. During the 9th century, the incursions of the Danes were destructive to the arts and many of the edifices already erected; and it was not until peace and good order were restored by Alfred, that any regular progress could be made in any of the arts of civil life. That inimitable prince extended his cares into every department which could promote the welfare of a well-regulated state; but the defenceless situation in which he found the kingdom, led him to direct the building art to military purposes, such as building and repairing walled towns, erecting castles, and constructing ships. About 960, Edgar is said to have founded forty monasteries, chiefly those which had been destroyed by the Danes, and he built the old abbey of Westminster.

Ramsay in Huntingdonshire.

In 974, the abbey of Ramsay in Huntingdonshire was completed; it was in the form of a cross, with side aisles, and two towers, one of which was at the west front, and the other was supported by four pillars in the middle of the building, where it divided into four parts, being connected together by arches extending to other adjoining arches, to keep them from giving way. This appears a new mode among the Saxons, as none of those which are more antient are described as having any thing of the form of the cross, or having towers above the roof. See Bentham's *Essays*.

Westminster Abbey rebuilt.

Early in the 11th century some change took place, for Edward the Confessor is said to have built Westminter Abbey, according to a new mode which was introduced into the kingdom, (*Mathew Prior*, p. 226.); and about this time it appears, that some excellent artificers flourished in France.

Saxons.
Saxons copied from the Roman buildings.
Moors.

The Saxons were reckoned one of the most fierce and warlike of the German tribes, with a very imperfect knowledge even of agriculture. When they conquered England, devastation was carried into the most remote corners, the public as well as private edifices were reduced to ashes, and the natives were slaughtered or carried into slavery; these people were, therefore, without any knowledge or habits of architecture. This knowledge was acquired after they were in full possession of England, had been converted to Christianity, became attached to fixed residence, and had accumulated property: (Hume's *History of England.*) The only regular architecture which could have come under their observation, was in the remains of Roman works, which had escaped or withstood their former fury. This must have attracted their attention, when they became disposed to construct buildings of any consequence; but their workmen were without knowledge or experience: (Somners' *Antiquities of Canterbury*, p. 146.) It was therefore absolutely necessary to have recourse to France or Italy, which was constantly done by those ecclesiastics, who had come to the resolution of building Christian churches: (*Ornaments of Churches considered.*) The Saxon architecture having been chiefly copied from the Roman works in Britain, the style which was practised during their age, in Italy, had a strong resemblance to it, and was constantly denominated the Roman manner. During the first age of the Christian era, when the Roman best style had been much departed from, the architecture of both the Christians and Moors was characterised by solidity and bulk, and particularly for having great numbers of round short pillars. It has been observed, that there is a near relation between the architecture of the Moors and that described in Scripture; and that in Barbary and the Levant it has continued the same: (Dr Shaw's *Travels*, p. 273.) One of the principal

History.

No buttresses in the Saxon style.

Arches semicircular.

Mouldings.

mosques of Cordova is distinguished by its capaciousness and a great number of low massive pillars: (Ray's *Travels*, p. 487.) The Saxon style is conformable to these relations. The general form of the earliest Saxon churches was that of the Basilica, being a simple oblong, with a portico and ambulatory. The chief entrance was the west end; and at the east end was a circular recess, resembling the Roman tribune, but now appointed to receive the Christian altar. Additions were afterwards made, which completed the form of the cross; and towards the termination of the Saxon government, towers were erected in the west front, and over the centre of the cross. The outer walls were of a great thickness, and had no buttresses. Within the great churches, there were sometimes three stories, which were occupied by the arcade, gallery, and windows. The pillars were short, massive, and round. The arches, in arcades, doors, and windows, were all semicircular. The principal door-cases were decorated with pillars and sculptured capitals. Round the arches were mouldings of great variety, with bas reliefs. The mouldings consisted of the indented zig-zag like Etruscan scroll, small squares alternately deeper flourished, with small beads, usually on the capitals of pillars; and on some of their latest works, was a carving like a trellis in broad lozenges. The base mouldings and capitals, though of exact dimensions, similar in mass, were much varied in the minute parts: (Dallaway's *Observations*. Carter's *Ancient Architecture in England*.) Though it would be difficult to mention many entire edifices now remaining, which are composed wholly of Saxon architecture, yet it may, in numerous instances, be pointed out in particular parts. Of different edifices, Elkstone and Quisington, in Gloucestershire, and the whole of Tickenocte church, near Stamford, are Saxon; also, the nave of Oxford cathedral, and sundry parts of St Alban's and Durham; enrichments of door-cases and windows will be found in Barfreston, near Canterbury; Durham cathedral and palace, Tutbery in Staffordshire, Romsey Hants, and Rochester. The door-way, east end of Kenelworth church, has the caput bovis, fret mouldings, and patera in the spandrils,—ornaments peculiarly Roman. *Archæologia*, vol. x.; and Lyson's *Gloucestershire Antiq.*

Edifices of Saxon architecture.

History.

Norman conquest.

The manners of the Anglo-Saxons were rude; they were ignorant of letters, unskilled in mechanic arts, and addicted to intemperance, riot, and disorder. The conquest by the Normans put the people in a situation to receive slowly from abroad the rudiments of science and cultivation, (*Hume.*) The Normans were moderate and abstemious, but much disposed to pomp and magnificence in their dress, and likewise in their public and private buildings. They introduced civility, learning and arts, and restored religion from the neglected state into which it had fallen. Bentham's *Essay*.

Edifices in Normandy.

Edifices in England.

Previous to the invasion of England, the Normans had constructed magnificent edifices in Normandy; and owing to the frequent intercourse with that place, and the introduction of Normans into the highest situations in the English church by Edward, who had been bred at that court, and partial to its manners, led to an imitation of the Norman style, especially in the Abbey church of Westminster, and in that of St Peter at Gloucester, both of which were erected during this reign.

Norman arch.

Character.

The Normans, as soon as they had completely subdued England, and established themselves in every part of the kingdom, prosecuted the erection of ecclesiastical edifices with great zeal and success. Their style was similar to that of the Saxons; and the chief difference consisted in their being of larger dimensions, in their having plain, but more lofty vaulting, circular pillars of greater diameter, round arches and capitals, with carvings much more elaborate and various; but in both there was a total absence of pediments and pinnacles, tabernacles, or niches with canopies. Dallaway's *Observations.*

Era from 1066 to 1154.

The era of the Norman architecture is reckoned from the conquest, in 1066, to the death of King Stephen in 1154; and their exertions will appear evident, when it is considered, that, during this short period, every quarter of the kingdom was ornamented by their works; and that fifteen English cathedrals, whose origin can be ascertained, exhibit undoubted features of Norman construction. The cathedrals of Canterbury and Battle Abbey were two of the finest structures of the conqueror's reign; and of the following, the bishops, whose names are annexed, were the architects.

Norman edifices and architects.

	Cathedrals.	*Bishops and Architects.*
1077 to 1107	Rochester, Canterbury, and Peterborough,	Gundulf, Bishop of Rochester.
1086 — 1108	Old St Paul's, ...	Mauritius of London.
1107 — 1140	Old Sarum, ...	Roger of Salisbury.
1115 — 1125	Rochester, ...	Ernulf of Salisbury completed Gundulf's works.
1123 — 1147	Lincoln rebuilt, ...	Alexander of Lincoln.
1129 — 1169	St Cross and Ramsay in Hants, ...	Henry de Blois of Winchester.
1154 — 1181	. . . .	Roger, Bishop of York.

During the erection of these works, Norman architecture was brought to perfection, and their magnitude had much exceeded that of their predecessors; also, in many instances, in delicacy and elegance of design, as in the fine specimens in Winchester cathedral, especially in the portal of the ancient Sacristy, between the east cloister door and south transept, which is the work of Bishop Walkelin, cousin to the conqueror, and finished in 1093; and there is also in the upper part of the south transept of the same cathedral some round intersecting arches, placed by way of ornament upon the outside. These, which were part of the original work, were finished in 1093, prior to the first crusade, and are perhaps the earliest authentic instances of the pointed arches in this kingdom. But in the church of St Cross, near Winchester, in the easter end, constructed by Henry I. 1132, are richly ornamented Saxon arches intersecting each other; which intersections are open quite through the wall, constituting highly pointed windows to the number of 20.

Churches belonging to abbeys.

Of the churches in this style, belonging to the greater Abbeys, the following are fine remains: Malmsbury, Wiltshire; Dunstable, Bedfordshire; Castle Acre, Norfolk; Wenlock, Salop; St Botolph's, Colchester. These magnificent works are a proof of the power, influence, and talents of the ecclesiastics of that period. The Roman pontiffs about this time arrived at the utmost plenitude of authority, and they were ably supported by prelates of that time. Amongst all the revolutions of civil government, the interests of the church remained protected, and continued regularly to extend its influence. This enabled them to execute works which appear sufficient to require the whole revenue of a state.

Pointed style commenced, A.D. 1154.

Lancet style perfected.

During the reign of Stephen, that is, from 1135 to 1154, the arches became slightly pointed: the heavy round pillar was divided and clustered, and by degrees converted into the tall slender pillar, supporting the sharply pointed arch, distinguished by the name of lancet; but still many ornaments of the preceding era continued to be used. In the reign of the third Henry, the cathedrals of Westminster, Salisbury, and Ely, are evidence of the perfection to which this elegant style had then been carried.

Distinguishing features.

Fine spires.

The distinguishing features of this style are tall and slender pillars, some of them, as in the nave of Worcester cathedral, are bound by fillets at certain distances, and insulated and clustered into a single column, with narrow lancet windows, and roofs upon simple cross springers; the arches sharply pointed, and the windows increased to three lights: There was sometimes a combination of circular and pointed, and still a mixture of the old ornaments; but perhaps the most striking of all the features of this period, is the lofty and finely tapered spire, which, in 1222, was constructed of timber, covered with lead, upon the lofty tower of Old St Paul's cathedral. The tower itself was 260 feet high, and the spire being 274, made the total height 534 feet This was under the reign of Henry III. See Stowe's *Survey of London*.

Norman style totally gone.

Under Edward I. every feature of the Norman style was totally rejected. Slender pillars of Purbeck marble were adopted. These were united under one capital, decorated with the leaves of the palm tree, and the pillars and arcades were modelled into an extreme of lightness.

W. de Wykeham.

Knots of foliage, statues, and flying buttresses.

Early in the reign of Richard the II. under the celebrated W. de Wykeham, additional boldness and decorations were thrown into the style. The capitals were constructed and sculptured with more ingenuity; the vaults were studded with knots of foliage at the intersection of the ribs; the western front was enriched with statues; and the flying buttresses, formed of segments of circles, were rendered highly ornamental. Dallaway's *Observations*.

Tracery.

Clustered columns.

Windows, tracery, and painted glass.

The ribs had also formed a considerable degree of tracery upon the vaults. The small columns were at last not placed separate from the body of the column, but, being united, composed it. The windows were greatly enlarged; they were divided by stone mullions, and spread, in the upper part, into many beautiful and fanciful ramifications. The eastern and western windows, in many instances, occupied the whole breadth of the nave, and rose nearly as high as the vaultings. And these windows, which were now filled with painted glass, exhibiting portraits and historical subjects, produced a magical effect, with which mankind had hitherto been unacquainted. In the cathedral and St Mary's chapel, now Trinity parish church at Ely, are pillars and windows of this style, and the chapel is reckoned one of the most perfect structures of that age. Bentham's *Essays*.

Crown of Becket's tomb, suggested the Louvre, Ely, and Canterbury.

It has been thought that the crown of Becket, in Canterbury cathedral, suggested the plan of the Louvre, of Ely, and Canterbury, which are fine specimens of this style; and that the crosses, erected by Edward I. afforded a model for the canopies, denominated tabernacle work. Dallaway's *Observations*.

Era 1272 to 1399.

With regard to the era of this style, the first appearance of the pointed arch was during the reign of Stephen (1135 to 1154); but the Norman features were not wholly rejected till Edward I. (1272 to 1307); and the termination of this pure style may be placed about the commencement of the fourth Henry (1399), so that the works which exhibit this particular style were executed in the latter end of the 13th and the beginning of the 14th century.

Crockets.

Much sculpture.

The distinguishing features have already been mentioned; but it is necessary to add, that the arches of the windows and niches, were ornamented with crockets tied at the top, in a knot resembling the blossom of the Euphorbium; the central towers became more lofty, and more ornamented; the cloisters, altars, screens, canopies, shrines, and even external western fronts, were highly enriched with sculptures, and the tapering spire was brought into use.

Edifices in this style.

It is impracticable and unnecessary here to enumerate all the instances where this style was executed; for it was extended to ecclesiastical buildings in every quarter of the kingdom; but the following are specimens which will convey a satisfactory idea of its excellency: The western parts of York, Peterborough, and Litchfield; the addition at Lincoln; the naves of Canterbury, York, Winchester, and Exeter; the choirs of York and Gloucester; and, for correctness of proportions and richness of decorations, the screens of Abbot Whitehamstead at St Alban's, and Bishop Fox at Winchester, deserve to be noticed.

Style changed.

Era 1399 to 1509.

Walls thin and high.

Parapets and pinnacles open work.

Pendants.

Images of angels.

Fan-work.

Edifices.

From the accession of the fourth Henry to the death of Henry the VII. in 1509, that is, during the course of the 15th century, the style of architecture was again completely changed. Mr Walpole is of opinion, that the Sepultural Saelta of the archbishops of Canterbury were the models for the style of this century. The walls were made of great height, but remarkably thin. The towers were ornamented with panelled arcades in every part of their height; and the parapets and pinnacles were formed of open embattled work. The vaultings of the roof were constructed with great ingenuity, and were made to unite with the groins formed by the arches over the windows; they were also formed into pendants of singular shape and workmanship. Over the high altar, instead of decorations, composed of architectural members, or imitations of leaves or flowers, images of angels and musical instruments in full choir were introduced. The cloisters, which had hitherto remained quite plain, had now their roofs overspread with tracery, which, rising from the springers, took the form and appellation of fan-work; and even the windows of these cloisters were filled with painted glass. Of this style, the finest specimens are, the chapel of King's College, Cambridge, begun by Henry VI., and finished by Henry VIII., and the sepultural chapel of Henry VII. at Westminster. The number and variety of ornaments, among which the armorial bearings had long been introduced, the exquisite delicacy of workmanship, and the extent of windows filled with painted glass, in walls of incredible thinness, but, above all, the singularity of the roof, produces a wonderful degree of surprise and admiration.

Profusion of decoration.

From this period, an insatiable disposition to vary and increase decorations, already so profuse, the dreadful havoc which took place at the Reformation, and the inclination which began to prevail of introducing the ancient Roman style, (which, early in the 16th century, had been revived in Italy,) led to all the confusion and despicable intermixtures which took place for almost a century.

Having now given as full an account of the state of architecture, from the decline of the Roman style to the period of its revival, as a work of this nature admits of, the reader is referred for farther particulars to the authors who have been occasionally mentioned. The Rev. Mr Dallaway, more especially, has given a very full, masterly, and well arranged view of the subject.

General observations.

The reader having now before him an account of the changes which the art underwent during the before mentioned period, and the leading historical circumstances connected with it, he will readily perceive, that always in Italy, and in Britain, till 1135, the great features are those of a depraved Roman style. He will recollect, that, about this time, the intercourse with the East, by means of the Crusades and settlements in Palestine, was frequent and extensive;—that, about this time, a corporation of builders, consisting of Greeks, Italians, French, Germans, and Flemings, united, under the sanction of papal bulls, to construct ecclesiastical buildings; and, for this purpose, travelled wherever their labours were required. The information acquired by the ecclesiastics who visited the East, when united with the experience and dexterity of this incorporated school of builders, and supported by the influence the church had acquired, will account for the improvements which took place, and for the expedition with which such a number of edifices, of so extraordinary magnitude and splendour, were every where erected. It will also open a wide field for speculation, respecting the probable causes for the variations in the manner which took place.

For the pointed arch, which, in the pure Gothic, is accounted a governing feature, there will be found a striking resemblance in the intersection of the beautiful Saxon or Norman arches in the cathedral of Winchester, constructed previous to the first Crusade; and in the east end of the church of St Cross, near Winchester, erected by Bishop Blois, 1132. There are twenty highly pointed windows which enlighten the chancel, formed by the intersection of circular arches. On the inside of the wall, the pillars which support these arches, and also others at Winchester, are divided into tall slender forms. Long, narrow, and lancet-pointed arches, are formed by the intersections of the circular arches, without pillars or mouldings, which are placed, by way of ornament, on the upper part of the outside of the south transept at Winchester. These casual occurrences may perhaps be reckoned to have afforded sufficient hints to ingenious men to improve into more perfect forms; and when united with the taste for minute and delicate ornaments, as practised by the Moors, and also with other ideas collected from the architecture of Egypt and Syria, and impelled by every motive which religious zeal, vanity, caprice, and the most ardent spirit of competition could impose, will probably, to many, afford a satisfactory explanation for the changes and improvements which took place, from the period of the most simple to that of the most magnificent and luxurious style of this school.

But such interest has Gothic architecture of late excited, that not only the periods in which it appeared have been disputed, but the claims of rival kingdoms, as to priority, have been contested with much ability and zeal. The late Mr Whittington has endeavoured to prove that the original hints came from Asia, and that France preceded and surpassed England in producing fine specimens of this school of architecture. While Dr Milner has boldly claimed the merit exclusively for our own country, and has, with much distinctness and assiduity, traced the progressive steps by which the changes took place. These two able men having taken masterly views of the architecture of the two countries, we cannot resist presenting our readers with a sketch of their statements, referring to their valuable performances for more perfect information.

Whittington.

Mr Whittington begins by observing, that the Roman architecture was only pure from the time of Augustus to that of Hadrian and the Antonines; that, in the works of Dioclesian, may be found arches springing from tops of columns, consols supported by figures projecting from the face of the wall, and even the zig-zag moulding. He says, that Constantine founded churches at Rome and Byzantium in the form of the ancient Basilica, of which there were 19 in Rome; and that Santa Croce in Gerusaleme at Rome, is the only specimen of the architecture of Constantine, and is thought to have been originally open at the sides. St Paul's, without the gates of Rome, built, in its present form, in the time of Valentinian and Theodosius and Arcadius: near the end of the fourth century it was inclosed on all sides. St Paul's is the best specimen of the manner of building, and St Clement's of the internal distribution of the first churches.

Gaul, 3d century.

Gregory of Tours.

In the 3d century there were seven bishops sent to Tours, Orleans, Thoulouse, Narbonne, Paris, Limoges, and Auvergne; and Constantine built a church at Auvergne. In the 5th century Gregory of Tours relates, that Pepetuus bishop of Tours built a church over the tomb of St Martin, 155 feet in length, 60 in breadth, and 45 in height; that it had 120 columns, 52 windows, and 3 doors in the sanctuary, and 5 in the body of the church. Naumatius, bishop of Auvergne, also built his cathedral in form of a cross, with aisles on each side which terminated in a round apsis; the walls of the sanctuary were incrusted with marble; it was 150 feet long, 60 wide, and 50 high, had 42 windows, 70 columns, and 8 doors.

Clovis.

St Genevieve.

Form oblong, sometimes a cross.

The manner of execution.

Leo, bishop of Tours.

St Denys.

Clovis, being converted, built many churches. He founded the abbey of St Peter and St Paul (near St Genevieve) without the walls of Paris in 507, also the church of St Peter at Chartres, and St Mesenin near Orleans. His son Childebert built the abbey of St Germain des Prez near Paris. It is said that the only remains of these works are the tower of St Germain des Prez, and that of St Peter at Chartres. The general form was oblong, with a semicircle at the east end. They were sometimes in form of a cross; the roof was supported by pillars of stone and marble, and covered with lead or gilt tiles; the altar and covered ceiling of apsis were incrusted with marble and Mosaic work, as were sometimes the western front; the walls were embellished with sculptures, relieved with painting; the windows were frequently glazed; there was a pediment in the west front perforated with a circular aperture, and afterwards with a rose window. The plans, it is said, were often made by the abbots, and their convent assisted in carrying on the work; in sundry times the ecclesiastics performed carving, smelting, painting, and mosaic. Leo, bishop of Tours, was a great artist, especially in carpentry. St Eloy, who was first a saddler, then a goldsmith, and at last bishop of Noyon, built the monastery of Lolognac near Limoges, but was most noted for shrines of gold, silver, and precious stones, especially those at St Denys and St Martin of Tours; he died in 668. The greatest work of this century was St Denys, by Dagobert, son of Clothaire. Pepin began to rebuild it, but it was completed by Charlemagne, and dedicated in 775. The vault of the crypt under the east end, and the great entrance of the present church, is said to be part of the work of Pepin and Charlemagne. It appears that, in the course of the 8th century, stone towers and belfries became common in France.

Charlemagne.

Low state of the arts.

The palace of Charlemagne at Aix la Chapelle and the church were decorated with the marbles of Rome and Ravenna, and executed probably by Italian workmen. The churches built in the time of this prince, were proofs of the low ebb of the arts. Here magnificent and beautiful pillars supporting pitiful arches, high walls disfigured with uncouth paintings and glittering Mosaic work, pillars of different forms placed in the same row, pavements composed of various and uneven fragments, timber of roofs left naked without ceiling or ornament. The churches of St Vincent and Anastasius, and St Laurence in Verona,, and St Agnes without the city, erected about this time at Rome, are specimens of this debased taste; and the internal walls of old St Peter's at Rome, were painted in this rude manner under Formosus I. in 890.

Louis's Edifices.

Rumalde, king's architect.

Under Louis, the successor of Charlemagne, the churches and monasteries of St Phillebert, St Florent upon the Loire, of Karoffi, Conches, St Maixant, Menat, Manlieu in Auvergne, Moissac, St Savin in Poictou, Nouaille, St Theotfroy, St Paixant, Lolognac near Limoges, St Marie, St Radegonde d' Agnani, St Laurent and Caunes. It was during his reign that Ebo bishop of Rheims began to rebuild his cathedral, on which occasion the king sent his own architect, Rumalde, to carry on the work.

Normans destroyed churches, &c.

Abbey of Clugny.

The Normans began their irruptions, and destroyed a great many churches, *i. e.* St Owen in Rouen in 842, and the cathedral of Chartres in 850. A few years afterwards they destroyed St Genevieve at Paris, set fire to St Germain des Prez, and ruined St Martin of Tours. Charles the Bald attempted in vain to check them. Notwithstanding these irruptions, sundry abbeys were built under his reign, as the abbey and church of St Benigne at Dijon. The most celebrated edifice of this period was the abbey of Clugny, built about 910, by Bermo abbot of Balme. Maignard, a canon of St Genevieve, is said to have built the entrance to that church in the reign of Hugh Capet.

Robert the Pious enabled Morard the abbot of St Germain des Prez to rebuild the church of his convent on a larger scale. St Genevieve was also restored, and a cloister added; he also made preparations to build a cathedral at Paris on a magnificent scale. Many religious structures were benefited by his encouragement.

Cathedral of Chartres.

Dimensions.

The cathedral of Chartres was one of the greatest works of this age. It was said to have been completed by its bishop Fulbert, who died 1028. Its length was 420 feet, breadth 108; the nave 48 feet wide, with side aisles 18½ feet wide, and 42 feet high; on each side the choir the aisles are double, and the transept, which is 210 feet long, contains aisles. There are seven chapels in the Chevet, and the crypt and lower church are very regular: This seems the first instance of regular and magnificent arrangement in France. Some reckon it to have been completed by Thierri or Theodoric in 1048. The northern part was built afterwards by Jean Cormier, physician to the king.

Rheims.

The church of St Remi at Rheims was founded by the abbot Hermez, and consecrated in 1049 by Leo IX. and the new cathedral of Scoz was completed (1050) under Azon a monk.

Clugny.

The abbey of Clugny, the largest ecclesiastical monument in France, was erected about this time. The abbot Odilo collected various marble columns by means of the Rhine; and Duromer, it is said, constructed a cloister. The present church was probably begun by the same prelate, but the chief part was built by Hugh his successor, about 1069. It was consecrated in 1169 by Innocent II. the length 620 feet. It has two transepts, the upper one is 200 feet, the lower 120 feet in length.

Style of the 11th century.

The style of the 11th century was the same as that of the preceding, but the works were upon a larger scale. With a few exceptions, the oldest buildings now existing in France may be traced to this æra, *i. e.* St Germaine des Prez, St Benigne at Dijon, Chartres, La Charité upon the Loire, and Clugny.

Saxon in England inferior to Norman.

Barbarous imitations of the Gothic continued all over Europe, with some difference in features. Saxon churches in England were inferior in magnitude to the Norman, and the latter differed from those near Paris and in the south of Europe. The Norman churches, though longer, were rude, and had less skill in sculpture than the French artists, who had improved by imitating the Roman works.

Abbey of St Stephen at Caen.

The abbey of St Stephen, raised by William the Conqueror at Caen, and that of the Holy Trinity, founded in the same city, by his queen Matilda, are the chief examples of the Norman introduced into England.

Crusades.

Pointed arch.

Notre Dame.

The Crusades began to rouse mankind, and light was brought from the East. During the 12th century the pointed arch made its appearance in the French edifices, and, in a short time, the Roman or Lombard style was discontinued. Amongst the earliest instances, was that at St Denis, begun by abbot Suguin, in 1137. About the same time the monastery of the Knights Templars at Paris, bore marks of the Gothic; the tower was built by Huber, treasurer of the order, who died 1222. In 1177, Stephen the abbot determined to rebuild St Genevieve, which he completed before he was made bishop of Tournay in 1192. About this time, Maurice de Sully, bishop of Paris, began to build the eastern part of the cathedral of Notre Dame, but it was not completed for two centuries afterwards. The choir of the cathedral of Lyons seems of this period, and the collegiate church St Nicholas at Amiens, was begun about 1192, and the portal finished in 1200.

At the beginning of this century the old Lombard mode was practised; towards the middle this was mixed with pointed arches; and, before the end of the century, the ancient heavy style was every where discontinued, and the new unmixed Gothic adopted.

Change of style.

Abbey of Bec in Normandy.

Rheims.

In the thirteenth century, ecclesiastical architecture reached its greatest perfection in France in 1212. Ingolramne was employed by abbot Richard to rebuild the abbey church of Bec in Normandy; he was succeeded by Waultier de Meulan, who finished it; but it was burnt and restored under Pierre de Caniba, about 1273. Rheims cathedral began to display the new style, and at Lyons the body of the cathedral was completed. The cathedral of Amiens, the pride of Gothic architecture, was erected by Robert de Lusarches, Thomas de Carmont, and his son Reynault. Notre Dame was carried on by Jean de Cholles; and Pierre de Mentereau was employed on the chapel and refectory of St Germaine des Prez, and Saint Chapelle, at Paris. Eudes de Montreuil was celebrated for his scientific skill and bold conceptions; he accompanied St Louis to the East, and on his return was employed in the churches of St Catherine de Val des Ecoliers, St Croix de la Bretonnierre les Quinze-Vingts, the White Monks, the Mathurins, the Carthusians, the Cordeliers, and the Hotel Dieu, at Paris; likewise the Notre Dame at Mantes; he died 1289. The vaulting of the roof in the latter astonished Lauflet and Gabriel for its boldness; the height from the pavement being 96 feet.

St Antoine, &c. in Paris.

The church and abbey of St Antoine, near Paris, the churches of Filles Dieu, the Jacobins, the Carmelites, and the Cordeliers of Fauxbourg St Marcel, were also

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built by order of the king; and likewise the abbeys of Lio, near Milan; of Longchamp, near St Cloud; and St Mathieu, near Rouen; the greater part of the abbey church of St Denis, the Hotel Dieu of Vernon, Pontoise, and Compeigne; and the church and abbey of Manbuison. The church of Notre Dame des Unes, in Flanders, was begun by Pierre, the 7th abbot, and completed in 1262, by Theodoric: the whole church was built by the monks themselves, assisted by the lay brothers and their servants. Robert de Coucy completed the cathedral of Rheims, and the church of St Nicaise for boldness and symmetry he surpassed all his contemporaries. Jean Rauy, an architect and sculptor, was employed 26 years upon Notre Dame.

Robert de Coucy.

In the reign of Charles V. the monasteries of the Augustines and Celestines were built at Paris; a magnificent chapel, on the model of the Sainte Chapelle, at Paris; and many important additions were made to the Louvre. Charles V. was the founder of the Royal Library of France; he placed 120 volumes in one of the towers of the Louvre. The abbey of Bonport was erected about 1387.

In the 14th century, windows in leaves.

Vaults rich.

The 14th century differed considerably from the last. The windows, instead of foils and roses, branched into leaves, and there were richer decorations upon the vaultings of the roof. Similar changes took place in England, where they were carried to a higher degree of perfection.

In the 15th century, France did not equal England.

The taste of the 15th century was inimical to architecture; it resembled that in England and other countries in the present day. There were many instances of tracery, especially in chapels and sepulchral monuments. The chapel of Charles de Bourbon, archbishop of Lyons, in the cathedral of that city, is a fine instance, and one of the latest works in the Gothic style produced in France. Charles de Bourbon died in 1478. The distracted state of France at this period prevented them from equalling what was done in England.

Restoration of Roman style begun.

The Italian artists about this time began to restore the Roman style, and painting and sculpture soon arrived at excellence; but in architecture, though the Gothic was abandoned, there was little of the pure Roman style in that which was adopted. It consisted chiefly in imitations of the Abarasque designs of Raphael, which he had copied from the frescoes of the baths of Titus and Livia, and introduced into the galleries of the Vatican, which met with applause in a generation too much accustomed to profusion of ornament to relish simplicity.

Having thus traced the progress of this school of architecture from its introduction into France to the reign of Louis the XIIth, which marked a total abandonment of it, Mr Whittington next proceeds to comment upon the principal edifices, and compare their merits with those of buildings of the same age in England.

Observations and comparisons.

St Germain des Prez.

Of St Germain des Prez, it is remarked, that the interior is low and gloomy, lighted by small windows, as in our Saxon buildings; but in the arches and columns of the choir, which have remained since the time of Morard, the general proportions, and especially those of the capital to the shaft, approach very nearly to the Roman Corinthian, while others are a sort of Abarasque, composed of birds and griffins, still retaining the Corinthian leaves and volutes. Here columns support a series of circular arches, excepting the circular arcade at the east end of the church, where they are pointed, in consequence of the arrangement of the pillars, which are placed nearer to each other than where the colonnade is a straight line. The same circumstance is found in the crypt at St Denis; in the choir of the church of La Charité sur Loire, and at the east end of Canterbury cathedral, built between 1180 and 1185, where "the arches are some circular, and some mitred, for the distances between the pillars here diminish gradually as we go eastward. The arches being all of the same height, are mitred (pointed) to comply with this fancy, so that the angles of the eastern ones are very acute. See Gostling's *Canterbury*, p. 221.

St Genevieve.

History.

With regard to the abbey of St Genevieve; in the time of the Celts, an island in the river Seine, surrounded by forests, was first resorted to for shelter. The habitations did not extend beyond the L'Isle de la Cite, which still retains the metropolitan church and palace of justice. This place was enlarged by the Romans, especially Valentinian and Grotian.

Clovis at first resided in the Roman palace, but afterwards erected one on rising ground near the south suburbs, and added a church to St Peter and St Paul, which was not finished at his death in 511. This church was afterwards named St Genevieve, after a pious lady, in whom the Parisians had great faith.

Description.

The abbey church has probably the same disposition, and partly the same walls, as in the time of Clovis. It is without transepts, but has a circular termination. It was only repaired by Robert the Pious, or by Abbot Stephen. The façade is remarkable for its nakedness; its portal consists of three pointed arches, with small columns and capital, decorated with ivy leaves; above the middle door is a rose window. The other windows are long and lancet-shaped, the whole enclosed by a massive plain pediment. The nave is separated from the nave aisles by eight columns; four, larger than the others, their capitals truly Lombard, being a mixture of leaves, birds, &c.; the four smaller ones have Acanthus leaves; upon these caps rest clusters of small pillars and pointed arches, erected by Abbot Stephen, to support the roof. This is an example of the exact shape of the early French churches, with narrow lancet windows, which are rare in that country.

St Denis.

History.

St Denis, or St Dionysius, was reckoned the first preacher of the gospel to the Gauls. The persecutors ordered his body to be thrown into the Seine, but a Pagan female got possession of it, buried it in a field near Paris, and sowed the field with corn; she afterwards erected a small monument over it, to which the Christians resorted, and built a church there, about the middle of the third century; but from its having been rebuilt on a larger scale, and endowed by Dagobert, he generally passes for the founder. Felibien places the commencement of the building in 629. It was oblong, with a circular termination, having marble colums within, and a profusion of Mosaic work: he also built cloisters and offices to the monastery. This church of Dagobert was taken down, and another built by Pepin and Charlemagne, and dedicated in 775. The Normans plundered it in 865. Suger was elected abbot in 1122, being nominated regent of France by Louis VII. on his departure for the Holy Land. He restored, added, and embellished it, especially the west front and towers. He discovered excellent stone in a quarry near Pontoise, and procured timber from the forest of Chevreuse, which he marked with his own hand. It was dedicated in 1140.

St Denis had lands in England, *i. e.* Tinton, in Oxfordshire; Rotherfield, in Sussex; and Deerhurst, in Gloucestershire. This edifice is externally very lofty, but the west front is deficient in majesty. The chief portal is arched semicircularly, and adorned with sculpture. The walls have alternately round and pointed arches in half relief, on small pillars, similar to those of Purbeck employed in England: the height of the towers is unequal. In St Denis, there are three eras of architecture: 1st, The

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Three eras of architecture.

Earlier examples of pointed arches than in England.

oldest ornaments in France. 2d, Lower church, beneath the chapel of St Denis, is part of the fabric by Pepin and Charlemagne. 3d, The pointed arch. The chapels of the Chevet and western front, are the work of Suger; also the pavement and painted glass. In his time, the columns were Lombard, but the pointed arch appears in every part of his works, which were about the middle of the 12th century, and are earlier examples than any to be found in England,—St Cross, near Winchester, built in 1132 and 1136, being considered as too dubious to be admitted as an instance. In England, the earliest mixed style appeared in 1154, under Henry II. The first used in vaults was begun by Roger of York in 1171; the vestibule of the Temple church in 1184; the western tower of Ely 1189; the choir of Canterbury 1175 and 1180; and two western towers of Durham in 1233; the latter being exactly in the style of Suger, at St Denis.

Description.

The nave, choir, and transepts of St Denis, by Eudes Clemont, and Mathieu de Vendosine, between the years 1231 and 1281, are equal to Amiens in magnificence and delicacy. The bold elevation which distinguishes the edifices of the French architects, is remarkable in this church, the nave being 90 feet high, and only 39 in width. The workmanship of the buttresses and tracery, is superior to Westminster. The upper range of windows fills up the space between the great arches and the vaulting, and are perfectly similar throughout; they are each 40 feet high, and each divided by four perpendicular mullions, terminated in arches, which support three six foils or roses; the distance between each is three feet. These are superior to any thing at that time in England. The French had introduced the pointed arch before the middle of the 12th, and constructed broad magnificent windows before the middle of the 13th century. This fine structure had fallen into decay in 1802: the vaultings had tumbled in, and the pavement was destroyed.

The crosses erected in 1285, on the road between St Denis and Paris, where Philip III. stopped with the remains of his father Louis, have also been all destroyed. Queen Eleanor, on whose account Edward I. erected crosses, did not die till 1296.

Notre Dame. History.

The church of Notre Dame at Paris, was founded by Childebert in 522, and became the cathedral of the diocese of Paris. Fortunatus says, it anciently had 30 columns, it was destroyed by the Normans, and the present church was founded by Robert the Pious in 1010. At his death it was neglected. Maurice de Sully has the chief merit of the present church. Pope Abu III. laid the first stone; and in 1181 the eastern part was consecrated. Pierre de Nemours, who died 1220, finished the nave and west front; the south was begun in 1257. The building of the chapels continued the greater part of the 14th century; so that the whole was completed in two centuries. The exterior has an excess of ornament in some parts, and a want of it in others. The buttresses are thick, plain, and heavy. The interior is heavy, from a mixture of styles. The body is divided into five aisles, by four ranges of Lombard columns of gross proportions. The Gothic work is without ornament or beauty; and its size alone produces effect. The eastern end is of a triagonal form, and very plain, and it is probably one of the earliest Gothic structures in France. The west front is a striking proof, that the French, at the end of the 12th century, has added great richness to the Gothic, which the English were at least half a century afterwards in producing. The three marigold windows, with their painted glass, are the most magnificent to be met with in any country.

Description.

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Description.

Comparison with English edifices.

Rheims, the most celebrated cathedral in France, was founded by Ebo in 818. Louis I. granted the walls and gates of the city, and sent his own architect Rumalde to carry on the work. The pediment over the entrance is ornamented with statues of Louis I. Pope Stephen V. and Ebo himself. Some additions were made by Archbishop Hincmar, who dedicated it in 862, in presence of the king. It was burnt on the 6th May 1210, the crypt of Ebo only being left. In the same year the foundation of a new one was laid, and the altar was dedicated 18th Oct. 1215. It was finished in 30 years, that is to say, the body of the church; for the ornaments of the grand façade were put up between that and the English war in 1295. The west front has long been the boast of France. The diminishing or pyramidal form, is more suitable in the Gothic than the square fronts of English cathedrals. It has no mixture of designs; it is rich and light; all that is massy is below, and every thing lightens as it ascends; the architecture is preserved delicate and light, as a relief to the sculpture. The portal is particularly magnificent. In this fine feature the English style is very deficient; even at York, Salisbury, Wells, Litchfield, Westminster, King's College Chapel, &c. In Rheims, the minute beauties are singularly fine; the pinnacles are decorated, and finished with figures, flowers, and crosses; and the fleurs-de-lis spread along the roof, as at Amiens and Abbeville, has a fine effect. The name of the original architect is lost; but Robert de Coucy directed the work during the 13th century. He died in 1311.

Abbey of Nicaise.

Description.

The Abbey of Nicaise at Rheims, was founded by Henry de Braine, Archbishop of Rheims, in 1229. The west end, portal, and front of the nave, were built under Hugh Libergici, who died in 1263. Robert de Coucy was employed to complete it. The transepts must have been left in an unfinished state, also part of the cloisters. These must have been the work that was carrying on from 1322 to 1328, after which nothing more is heard respecting it. This edifice, though not large, is admired for its proportions, lightness, and delicacy of execution, and for its decided Gothic character. Its merits consist more of perforation and relief, than sculptured ornaments. Like Rheims and Amiens, its outline of front is pyramidal; the portal, though small, is prominent and bold, and the rose window over it enriches the façade; the perforation of the towers has a peculiar effect, the unadorned buttresses of which required relief. The whole is decorated with double rows of slender columns on each tower, and the fine arcades with which they are united.

Comparison with English.

The windows and perforations of the work of Hugh Libergici, performed in 1229, have the same width, and mullions were used in England for the first time in Westminster Abbey, but which were at this time unknown in this country. Nicaise had western towers, of which, at that period, there were no instances in England. Rose windows were not equalled here for half a century afterwards. Trefoils, arches in half relief, and opus reticulatum, were then common to churches in both countries.

Amiens.

With regard to the cathedral of Amiens, so remarkable for beauty and lightness, the date is ascertained to correspond nearly with that of Salisbury; they were both begun in the same year, and, in both, the same plan was adhered to throughout: they are, therefore, fair subjects of comparison.

History.

The former cathedrals of Amiens had been consumed by fire. The present edifice was begun in 1220 by Bishop Evrard, and is reported to have been finished under Bertrand d'Abbeville in 1269, but it was not quite completed till 1288. Probably the statues on the west front, the pavement, and fitting-up chapels, might occupy a considerable time after the general parts of the building were finished.

The architects were, 1. Robert Lusarches. } See *Antiquit. of Amiens.*
2. Thomas de Cormont.
3. ——— Reynault.

The foundations of Salisbury cathedral were laid 4th May 1220. The east part, with the first transept, were completed in four years, when the three altars were dedicated by Bishop Poore. The rest of the building was proceeded with during his pontificate; and those of Robert Bingham, and William of York, and the whole was completed in 1258 under Bishop Bridport, when it was dedicated by Boniface, Archbishop of Canterbury, in presence of the king. The external decorations were not finished till two years afterwards. The chapter-house, cloisters, muniment house, &c. were carrying on for ten years afterwards.

Comparison with Salisbury.

The following are the points in which Amiens and Salisbury agree. In the highly pointed arches struck from two centers, and including an equilateral triangle between the imposts and crown of the arch. The lancet windows, and Purbeck marble pillars, very slender and round, encompased by marble. Shafts a little detached, and a profusion of little columns of the same stone in the ornamental parts of the building. The arches or vaultings of the aisles are similar to those of Salisbury and Westminster; the west part is covered with small columns, and the lancet shaped arch is employed to crown the semicircular colonnade at the east end of the choir. The vaulting is like that at Salisbury, high, pitched between the arches and cross springers, without any further decoration.

The following are the points in which Amiens differs from Salisbury.

1. In the disposition of the aisles with the transepts; double aisles on each side of the choir, with the fine semicircular colonnade at the end of it; in the number of columns presented in every point of view.

2. In the proportions, especially the loftiness of the pillars belonging to the arches.

3. In the west front, portal, and display of statuary, in its armies of prophets, martyrs, and angels, which line the doorways, crowd the walls, and swarm round the pinnacles. If Salisbury has the advantage of lightness, it is to be observed, that not lightness but richness was invariably the chief object in this part of the edifice.

4. At Salisbury, Lincoln, and York, the arch buttresses were concealed in the roof of the side aisles, so late as the end of the 12th century. At Amiens, the profusion, of perforations, and decorations, renders them strikingly ornamental.

Chief difference.

5. But the chief difference is in the size and magnificence of the windows. In Salisbury, the long, narrow, sharp-pointed window, generally decorated both inside and outside with small shafts, often combined together and surmounted by a rose, are every where employed. In Amiens there are two tiers of windows, each divided by three perpendicular mullions, surmounted by the same number of roses; those at the east end have five mullions, and are crowned by a pediment, ornamented with a trefoil. Three circular or rose windows enrich the transepts and west front. The whole cathedral is so light, that, excepting the west front, scarcely any wall is visible. Internally there is no row of open arcades between the arches of the naves and upper tier of windows, as in our cathedrals. The whole is much lighter, and more elegant than either Salisbury or Westminster, and proves, that France had made earlier progress in various combinations of Gothic ornaments than England.

Having given the substance of what Mr Whittington has, with so much ingenuity, observed respecting the Gothic architecture of France, we shall now, in the same cursory manner, introduce the sentiments advanced so ably by Dr Milner in favour of England.

Dr Milner.

Dr Milner sets out by stating, that he means to prove, 1. That the whole style of pointed architecture, with all its members, grew by degrees out of the single pointed arch, between the latter end of the 12th and early part of the 14th century. 2. That the pointed arch was discovered from observing intersecting semicircular arches, with which the architects of the latter end of the 12th century decorated their edifices. And, 3. That both these discoveries were made and perfected by the Anglo-Normans and the English.

Establishes three orders.

He establishes three orders in the pointed style, quite as distinct as the Grecian architecture in their several members and proportions; and states, that the essential characteristics consist in the degree of angle of the pointed arch.

1st order at Canterbury.

The *first order*, has very sharp-pointed arches, with pillars and mouldings very heavy and nearly Norman, as found in the east end of Canterbury cathedral, where there is also pillars composed of two three quarter columns united; the plan resembling the figure 8, which is probably the first attempt at clustered columns. Here, as was formerly the general case, the east end was circular, and the bishop's throne and stalls for the clergy, were at the back of the altar, till about the beginning of the 13th century, when the large east windows were introduced in a straight line, and the altars placed under them. Although Gervase was a monk of Canterbury, and an eyewitness of the works carried on, yet, in describing what was done, he never intimates that any part of the style was brought from Syria, Arabia, France, Spain, or Italy, but attributes the merit to the architects employed, both of the name of Williams.

2d Order at York.

The *second order* was employed in York minster. Here the principal columns are divided into clusters, apparently slender, and crowned with historic capitals. From the capitals spring three principal ribs, and two lateral ones, which meet similar ribs from the adjoining columns, and form arches for the magnificent windows of the nave. The mullions continued down to the bottom of their story, form those of the light and uniform triforium gallery; other shafts of the main cluster sustain springers of arches of the intercolumniations, and other springers meeting corresponding ribs from the clusters of the side aisles. The arches are finely shaped, and include equilateral triangles.

3d Order in Henry Seventh's chapel.

The *third order* is exemplified in Henry VII.'s chapel, unrivalled for magnificence, ingenuity, elegance, and delicacy. The pendant capital is its most striking ornament, and the outlines of the arches in intercolumniations are exceedingly obtuse and flat.

First churches inclosed by curtains.

Dr Milner, after describing the churches of Constantine as ancient basilicæ, either imitated or merely inclosed, sometimes by curtains only, and lighted by small round headed or square windows, states, that such were probably the first constructed at York, Lincoln, Rochester, &c. for the Romans were not so much masters of Britain as to build fine structures before their architecture was vitiated. In the course of the 5th century the Ostrogoths and Huns overran Italy; the Visigoths and Suevi, Spain; the Franks and Burgundians, Gaul; and the Saxons, Angles, and Jutes, South Britain. These barbarians destroyed innumerable edifices, but erected none.

Saxon was Roman ill executed.

Roman church at Canterbury.

Wattles.

Wood.

Wilifred glazed the windows of York; he frequently visited Rome; his ornaments found in Italy.

The Saxon architecture was not introduced by the Saxons, but by missionaries from Rome, when they converted the natives at the end of the 6th century; it was Roman, but very rudely executed. They at first made use of a church their ancestors had spared. St Augustine found a church at Canterbury built by the Romans, which was called St Martin's. These missionaries, and the first converts, were at first content to construct them of oaken planks and wattles, and thatch them with reeds. Such a church still exists, or did exist not long ago, at Greenstead in Essex. Paulinus built one at Catarick, which was burnt by the Pagans; he also built one of wood, the mother church of British Christianity, in place of one of wattles and hurdles, and inclosed the whole building with a covering of lead. Wilifred, in the latter part of the 7th century, built Rippon and Hexham, and repaired York, and glazed the windows; but his visits to Rome, his instructions from Archdeacon Boniface, and the Roman workmen he engaged, enabled him to proceed so successfully, and carry his great works to such perfection; even the minute decorations of the Saxon were brought from Rome, but the logs and anchors, caulicolæ and volutes, and all the regular entablatures, had been laid aside before our Saxon ancestors began to build. The incapable workmen rejected all the rich and fine parts; and in imitating the Corinthian capitals, preserved only the stems of the volutes, and introduced animals, &c. The zig zag billet-cable, embattled fret, lozenge, corbel table, may be found in buildings, medals, tesselated pavements, and sepulchres in Italy.

Essendon church doorway Saxon.

No buttresses.

Saxons had towers.

Had bells in 680 A. D.

It is difficult to find original Saxon. The doorway of Essendon church, near Stamford, is known to be Saxon. The portals are generally round headed, with rude carvings in circular parts, while the door itself is of a square form. Saxon edifices are distinguished by their small dimensions, thick walls without buttresses, small windows with round heads without mullions, low cones which cover the towers and flank the corners of the buildings; and also by the rudeness of the workmanship. Mr Bentham is mistaken in saying, that the Saxons did not build high towers till the 10th century, for Richard, prior of Hexham, observes, "that St Mary at Hexham had a tower of a round or cupola form, from which four porticos proceeded; and this resembles Sophia at Constantinople, built about the same time." And Eadmer of Canterbury says, that there were anciently two towers, one over the south and another over the north transepts. So that Mr Bentham was also mistaken in maintaining that the Saxons had no transepts, since both Hexham and Canterbury were in the form of a cross. He also denies that bells were used till the 10th century; but it is clear from Bede, that large bells for assembling congregations were used in 680.

Churches of the Normans built previous to the conquest.

During the 9th and 10th centuries, the Saxons in Britain, and the Franks in Gaul, both then civilized, were as much harassed by new hordes of northern barbarians, as they had, four centuries before, afflicted others. The Danes and Normans overwhelmed and destroyed every thing before them. France, by giving up Normandy, compounded with them, and restored their ecclesiastical edifices with incredible expedition. Robert the Pious, who began to reign in the latter end of the 10th century, built 14 monasteries, and 7 other churches; but even he was outdone by the newly converted Normans in what regarded religion and learning. William I. previous to the invasion of England, built two abbeys in Caen, St Stephen and the Holy Trinity; and his nobles built 38 others, besides what were erected by the prelates. The abbeys of Bec and Caen became the most celebrated school in Europe; most of the prelates who rebuilt the English cathedrals in the latter end of the 11th and beginning of the 12th century, had been educated at one of those places.

Saxon cathedrals demolished and rebuilt.

Dimensions.

Immediately after the conquest they got possession of the great ecclesiastical benefices. Almost all the Saxon cathedrals were demolished, and rebuilt on a larger scale by Mauricius in London, Lanfranc at Canterbury, Thomas at York, Walkelem in Winchester, Gundulph at Rochester, William at Durham, St Wulstan at Worcester, Robert at Hereford, Herbert at Norwich, St Anselm at Chester, and Roger at Sarum. The abbots were not less zealous, the monasteries, as St Augustine at Canterbury, St Albans, Evesham, Glastonbury, Ely, St Edmundsbury, were all rebuilt. Hugh Lupus sent for St Anselm, then prior of Bec, to direct the building the church of the monastery of St Werburgh at Chester. The rage for building became excessive, and led to improvements in an art not confined by rules; the parts mostly remained the same as the Saxon, but the general dimensions were greatly enlarged. The Saxon cathedral of Dunwich was only 120 feet long and 24 wide, (Wilkin's *Archæol.* vol. xii. p. 166.); the celebrated church of Abingdon only 120 feet long; but the Norman cathedrals of York and Lincoln were each 490 feet long; Winchester 500; St Alban's 600; London old St Paul's 690 feet long; and York minster 99 feet. The height of the latter up to the crown of the vault under the beams of the roof, was 102 feet. The buttresses were at first broad, thin, and shelving upwards, without any ornaments, but the workmanship was superior to that of the Saxons. The Norman windows and portals were larger than the Saxon, and supported by pillars at the sides.

Gundulphus visited the holy Land; but he found no pointed arches.

Gundulphus, bishop of Rochester, one of the greatest builders of that age, visited the Holy Land previous to the Crusades; but in none of his works is there one specimen of the pointed architecture to be found. Pocock, Norden, Shaw, Le Brun, found only one church, and that was built in the pointed style in the time of Richard I. by an Englishman. The first crusade began in 1096; Jerusalem was taken in 1099; but no feature of the pointed style was brought from that quarter; neither Exeter, Rochester, or Reading had any in their original works.

No pointed arches in Persia before the 13th centu

In Persia there were no pointed arches earlier than Gengis Khan, in the 13th century. In India there are mausoleums with cinquefoil, but they are of a late date. The temple of Madura is not ancient. The ancient excavations in India, are the same as the primitive style of Egypt, which was also the parent of the Greek. Joseph's Hall in Cairo was built by the rival of Richard I. Saladin, whose name was Jusseff, probably by means of Christian captives after the third crusade. St Sophia, the model of the Turkish mosques, has no pointed arch.

Batalha built by an Irishman.

Bishop Warburton says, that the northern Goths in Spain struck out Gothic architecture in imitation of the groves in which they had formerly worshipped, and executed it by means of Saracenic workmen; but the Goths and Vandals entered Spain in 409; the Moorish Saracens not till 712; and the pointed architecture did not appear till 400 years after. Instead of England drawing instruction in Gothic from the Peninsula, Batalha was built by David Hacket, an Irishman, 200 years after this style had been practised in England. It is only a variety of Winchester and St Stephen's chapel, and not equal to them in sublimity or beauty. The cathedral of Burgos, built in 1221, is more gorgeous but less elegant than Salisbury, and not so magnificent as Lincoln. The specimens from Italy and Sicily, which were produced by Mr Smirke to the Antiquarian Society, have been detected by Sir Harry Englefield to have been additions in times posterior to the original buildings.

Smirke's specimens no evidence.

Dr Milner having proved, that the pointed style was not imported into this country, proceeds to trace its rise and progress in England.

Progress of the Gothic in England.

1. The intersections were at first sometimes only plain semicircles, as in the south transept at Winchester.

2. Resting upon pillars with capitals, or at least an abacus by way of impost, as on the north transept of Durham, the façade of Lincoln; in the latter instance they present a pointed arch with a cusp.

3. By the addition of one or more cusps on each side of the pointed arch, they made a trefoil cinquefoil.

4. By four cusps being introduced into the plain circle, or *oeil de bœuf*, it was converted into a quatrefoil or cross, and by adding more it became a catherine wheel or marigold window. But these did not make their appearance until the beginning of the 13th century.

5. During the latter part of the 12th century, is to be found, as usual, during a change, a mixture, or, as Carter calls it, a struggle between the circular and pointed style. This would not have been the case had the latter been copied from models in Syria, Spain, &c. The first pointed arches, were sometimes obtuse, as in St Cross, but more frequently very acute, as in St Mary Magdalene on the Hill, built in 1174.

6. Pointed arches were used alone before any other feature of that style.

7. The heavy columns were next made into the form of 8, and in ornamental arcades they were very thin and of Purbeck marble, as in the east end of Canterbury cathedral, rebuilt from 1175 to 1180, by William of Sens, and another person also named William Gervase, who knew the old cathedral burnt down in 1174, and was present when the before mentioned repairs were made. He describes the difference which took place in 90 years from its former construction, viz. that the pillars of the new choir were of the same form and thickness, but 12 feet longer than in the old; that the former capitals were plain, and the new delicately carved; that there were no marble columns in the old, but an incredible number in the new; that the stones of the ancient arches were cut with an axe, but those of the new with a chisel; that the vaulting of the side aisles, formerly plain, were now pointed with keystones; that the old was covered with a flat ceiling ornamentally pointed, while the new one was elegantly arched, with hard stone for the ribs and tough stone for the interstices; finally, that there was only one triforium or gallery round the ancient choir, and two in the modern one. Twenty years before the close of the 12th century, no member of Saxon architecture remained in the chancel or choir of Canterbury, except the main arches of the basement story, and certain billet mouldings, which gave way as the work advanced upwards, to the quatrefoil moulding, which very soon became universal, and is a sure criterion of the first order of the pointed style in its most pure state.

8. Canterbury having set the example, others followed as they required repairs. Lincoln in 1195; the choir of Worcester in 1202 to 1218; also the galleries and inside work of Litchfield, and the east end of Winchester, by Godfrey de Lucy, in 1202, were built in the same style, with lancet-shaped arches.

9. Five of these lancet arches placed under one arch, left a space which required to be ornamented with trefoil, quatrefoil, &c. as in the south cross aisle of York, built by Archbishop Walter de Grey in 1227; while the same style was going on at Salisbury, where, on the façade, there is a trefoil at the top of the pediment over pointed arches, and also Purbeck marble columns, with cusped capitals. In the upper story of Salisbury there are three lancet windows placed together, the middle one being raised higher than the others.

10. At this time, the cornice or moulding, which had formerly been attached to the moulding of the arch of the window, was now, by following the including arch, raised much higher than the window arches; it was terminated with a trefoil, but as yet had no crockets.

11. The north transept of Westminster, begun in 1245, (with the exception of the catherine wheel), remains nearly in the same style. Here the windows of the side aisles and upper story are larger and well proportioned, with cinquefoils in their heads; some have a triple cinquefoil under a pointed arch. The arches and windows being placed in rows above each other, led to the idea of the great window with mullions. In the inside of the transept are statues of tolerable workmanship; and on the outside are niches, with pedestals and plain canopies.

Changes in the time Edward I.

1. During the reign of Edward I. (begun 1272) pointed architecture changed its character: The arches, which had been too sharp, became better shaped. They had always one or two cusps on each side of the head, forming trefoils, &c. They had also newly invented mouldings; and the pediments over arches were ornamented with foliage, called Crockets.

2. The pinnacles, which had hitherto been quite plain, were now placed at the side of each arch, on the top of every buttress, and were decorated with crockets, and had a flower on the top, called a Finial. A pinnacle of a larger sort was placed on the great tower, and became a spire, as at Salisbury.

3. The flying buttress, for supporting the upper walls of the nave, which before had been concealed in the roof of the side aisles, was now exposed, and rendered ornamental. The plain niches of the 13th century, were early in the 14th decorated with rich tabernacle filled with statuary.

4. The windows were formed with mullions and transoms, into four, five, six, or sometimes nine bays, and had their heads decorated by tracery and flowers. What favoured the introduction of large west windows, was the abolition of canonical penances, and, of course, penitentiary-porches, in consequence of the frequent crusades.

5. Ribs, in groined ceilings, were no longer simple intersections, but branched into fine tracery, and were tied where they met by a knot, boss, or orb, usually decorated with some device; as in the work at York-minster, early in the 14th century.

6. Pediments, or canopies, which had, during the two first Edwards, risen straight up like an equilateral triangle, began, towards the end of the third Edward, to form a sweeping curve, as may be seen in Winchester College Tower.

Specimens where to be found.

These changes are very evident in Geddington and Waltham Crosses, erected by Edward I.; also in the tomb of Edmund Crouchback, brother of Edward I. in Westminster Abbey: He died in 1296. But the most perfect example is the nave of York-minster, built from 1290 to 1330, and the choir built thirty years after; and St Stephen's Chapel, Westminster, built by Edward III. in 1348; but few vestiges of it remain. Before 1321, the Lady Chapel was added to Lichfield, the whole was groined, and the beautiful western façade constructed; as was also about this time the nave of Westminster.

In 1381, the nave of Canterbury was rebuilt under Courtney and Arundel; and the nave of Winchester was changed by William of Wykeham.

By looking into the roofs of the side aisles of Winchester, or at the west front of Gloucester, St Alban's, and Rumney churches, it may be seen in what manner the circular architecture of the 11th was changed into the pointed of the 14th; and this taste was extended even to parish churches, especially to the windows.

St George's, Windsor, &c.

This pointed style of architecture occupied little more than four centuries. As it acquired its character by being elevated above the semicircle, so its decline commenced by a depression below that standard. This took place in the latter end of the 15th century, of which the most celebrated examples are St George's Chapel at Windsor, built by Edward IV. who died in 1483; King's College Chapel, Cambridge; and Henry Seventh's Chapel, Westminster. The architects were Bishop Cloose and Sir Reginald Bray. The royal chapels and oratories during the reigns of the two last Henry's, are covered with a redundancy of tracery and ornaments of excellent execution, but tiresome from its excess and want of relief. The whole walls of the edifice were converted into a glass frame. The Lady's Chapel at Gloucester is a striking example of this style; but from this false taste must be excepted the cathedral church at Bath, built by Bishop Oliver King in 1500, and the chancel of Winchester, built by Bishop Fox in 1525.

Walls made a mere glass case.

The chief symptoms of the decline of this pointed style, were rendering the walls a mere glass case, depressing the arches, employing a redundancy of tracery ramified into fibres, and loaded at meetings with heavy armorial bearings, badges and releuses, towers covered with hemispherical cupolas, and portals inclosed with square architraves.

Review of the three orders.

1st order.

The first order of the pointed style is to be traced up to Henry I. in 1132, or more certainly to the beginning of Stephen, 1136. It was perfected before the conclusion of the 12th century, and continued till near the conclusion of the 13th century. It is distinguished by its sharp arch, pillars frequently Saxon, but afterwards by detached slender shafts, groining of simply intersecting ribs, plain pediments without crockets or side pinnacles, the windows either without mullions or only having a simple bisecting one, and with a single trefoil or quatrefoil, or other flower, at top. The specimens are the east end of Canterbury, west end of Lincoln, the whole of Salisbury, and the transepts of York and Westminster.

2d order.

The second order reigned from the latter end of the 13th to the middle of the 15th century. Its characteristics are, the finely formed arch, including an equilateral triangle, clustered columns, formed mostly of one stone, elegant and chaste tracery in windows and groins, crocketed pinnacles, tabernacles, and pediments; the latter, towards the end of the 14th century, being formed with a sweep. The specimens are, the nave of Westminster, nave and choir of York, naves of Winchester, Exeter, Canterbury, Wykeham's two colleges, and St Stephen's, Westminster.

3d order.

The third order has been minutely detailed in mentioning the symptoms of decline. It reigned from the latter end of the 15th to nearly the middle of the 16th century. The specimens are, St George's Chapel at Windsor; King's College Chapel, Cambridge; and Henry Seventh's Chapel, Westminster.

General remarks.

Having distinctly traced the progress of the pointed style in England,—having also arranged it into three separate orders, distinguishing the periods in which each was employed, and referred to numerous and splendid specimens now existing,—Dr Milner, with the view of removing some objections and assumptions made by Mr Whittington, concludes with the following remarks:

Remarks.

There is no good reason for alleging, that the intersecting and open pointed arches of St Cross, near Winchester, were not a part of the original structure, but introduced in subsequent alterations and repairs; because,

1. Without the twenty windows, the whole would have been dark at noon-day.

2. The cornice from which the pointed arches spring goes quite through the wall, and is evidently a part of the structure.

3. The pointed arches in the south transept are the same as the windows, both in regard to design and workmanship.

The primary object of the inventors of pointed architecture being to excite devotion and awe, for this purpose they studied sublimity rather than richness: Hence the portals of Amiens and Rheims are, notwithstanding the armies of saints, prophets, martyrs, and angels, inferior to those of York and Litchfield. Admitting the French taste, the façade of walls would be the most beautiful of our English cathedrals. But the same false taste prevails in producing Amiens as a model of perfection, on account of having the appearance of being all windows; and Dr Milner produces the choir of Lincoln and nave of York as superior to the same parts in the boasted cathedrals of Beauvais and Amiens.

Conclusion.

Having impartially sketched out the views taken by these well informed men, of the rise and progress of Gothic architecture in France and England, the reader will form his own judgment respecting the claims of the two countries. We shall probably be not far from the truth in admitting, that the advantages were mutual, and that benefits alternately flowed from the operations on each side of the channel. That the French and Normans had, earlier than the Saxons in England, erected splendid ecclesiastical edifices, must be admitted; and that the English did not acquire information from examining the French works, during the wars they carried on in that country, is improbable; but, on the other hand, as England was tranquil while France was harassed during the 14th and 15th centuries, it is admitted, even by Mr Whittington, that the former country was, from that circumstance, enabled to carry Gothic architecture to a greater degree of perfection than the former; and without disputing as to the mere discovery of the first, or exclusive claim to the latter, the regular steps so distinctly traced by Dr Milner, seem to secure to England the merit of forming, and practising most extensively, the second or most perfect order of the pointed style.

This Gothic school is not more remarkable for the elegance of its forms, than the scientific skill with which the essential parts are adjusted. The small quantity of materials employed in edifices of great extent and elevation, when compared to similar Greek and Roman works, resemble films of net work, or slight frames of timber or iron. To construct edifices of this description, with small sand stones, so as to be stable and lasting, far surpasses the efforts of ancient artists, whose trust was reposed in the hardness and magnitude of their materials. In Gothic construction, all depended upon the correct adjustment of the bearings and thrusts of the different arches operating in various directions; not opposed by thick walls, but balanced by each other, and by buttresses and pinnacles, apparently only objects of decoration.

The Greek architects having no arches, had only to

Comparison of the Greek and Gothic.

arrange perpendicular pressures, and the strength of lintels from pillar to pillar, and for this their fine marble quarries afforded a material which removed all difficulties. They had, it is true, the principle of arches in the construction of their timber roofs; but this was rendered an easy task, by introducing ranges of pillars in the inside of the cells. The architect, therefore, instead of studying the principles of geometrical construction, directed his whole attention to that magnificence, which consisted in the magnitude and masterly execution of columns and sculptures.

Pinnacle and spire.

Conjecture concerning their origin.

The outlines of the Greek architecture, excepting the roof, were all horizontal or perpendicular; those of the Gothic were perpendicular, or tapering upwards, as the pointed arch, the pinnacle, or spire; and those were generally constructed with stones of very small dimensions. In the spire of Salisbury, which (besides the tower) is 180 feet high, the walls are only seven inches thick. It is not improbable, that this pyramidal form was brought from the East or from Egypt, or copied from some Roman remains; as there are instances, besides the Egyptian pyramids and beautiful obelisks, of the Romans finishing their mausoleums or sepulchres with a small pyramid. There is one of this shape near Terracina, on the confines of the ecclesiastical state, on the side of the highway leading to Naples. It was discovered by Perro Ligorio in 1573. It seemed to him fully as old as the Appian way, to which it was adjoining. *Parallel of the Ancient Architecture with the Modern*, by Rowland Freart.

Spires at Salisbury, Grantham, Coventry.

These spires, one of the most striking features in Gothic architecture, are, in their purest and most perfect forms, peculiar to England. The finest are those which are lofty, contained within small angles, and which have not their outlines broken by any ornament. In different parts of England there are many very beautiful spires; but the most lofty are those at Salisbury, Grantham, and Coventry.

Revival of Roman Architecture.

Roman [illegible]

Buscheto.

Brunileschi.

Plate CLXXIII.

While, during the latter part of the 15th and beginning of the 16th century, the ornamental Gothic was carried to luxuriant extravagance in England, the ancient Roman architecture began to occupy the attention of men of talents in Italy. In 1016, Buscheto, a Greek of the island of Dulichio, constructed the cathedral of Pisa with marble columns and a dome. He had many disciples, and was reckoned the founder of modern architecture in Europe. Early in the 15th century, Filippo Brunileschi, a Florentine, born in 1377, whose ardent and original mind led him to study, and form his taste from the remains of ancient buildings at Rome, undertook and completed the cathedral of Florence with an octagonal cupola of great dimensions, which a convocation of the architects of that age (1420) had pronounced impracticable. (See Plate CLXXIII.) The completion of this edifice, the example of the other excellent works in which he was employed, and the perusal of the writings of Vitruvius, created a general disposition to this style of architecture. This was increased by the treatise *De Re Ædificatoria*, which was shortly after published by Leon

Alberti.

Battista Alberti, a learned canon of the metropolitan church of Florence, born in 1398, who also practised architecture. His principal performance is reckoned the new works and embellishments of the church of St Francis at Rimini. These circumstances were preparatory to the great undertaking which fixed the epoch of the revival, and gave to the Christian world a temple, which, in magnitude and variety of parts, far surpassed every Grecian and Roman work of a similar description. Under

Bramante.

Plate CLXXIV.

Architects of St Peter's.

Vignola.

Julius II. Bramante, a native of the duchy of Urbino, born in 1444, having been distinguished by his talents in various architectural works at Rome, under Pope Alexander VI. was employed first to design the great theatre between the old Vatican and Belvidere, and afterwards the plan for St Peter's church; (See Plate CLXXIV.) and that magnificent structure was carried on under the direction of Raphael de Urbino, the friend, some say the relation, of Bramante. Baldasse Poruzzi, Frater Johannus Jocundus, Antonio Sangallo, Michael Angelo, Buonarroti, Guilio Romano, and Giacomo Barozzi, known by the name of Vignola, from a place in the Modenese, where he was born in 1507,—these eminent men planned and conducted many churches and palaces; and Vignola, from his elaborate publications, and fruitful yet sober invention, has been not improperly styled the legislator of architecture.

Palladio.

His works.

Plate CLXXVII.

During the pontificate of Leo X. architecture, sculpture, and painting, were greatly encouraged. Andrea Palladio, born at Vicenza 1508; Sebastian Serlio, who flourished in Lombardy about 1530; and Vicenza Scamozzi, born at Vicenza in 1552, all cultivated the ancient style with great success; more especially Palladio, whose unwearied and faithful labours in examining the remains of ancient structures, combined with the taste and skill with which he transfused their style into the numerous edifices for which he was architect, and his able treatise published in 1570, have obtained for him the title of the restorer of Roman architecture. The reputation which he early acquired, afforded him numerous opportunities of constructing works of various descriptions, and of great magnificence. Of these, the theatre at Vicenza, and the Villa Capra, or Rotunda, (see Plate CLXXVII.) are fine specimens of his genius and skill, and justify his title to the appellation of the Raphael of Italian architects.

France.

Church of the Invalids by Mansart.

St Genevieve by Soufflet.

Perraul builds t south fro of the Louvre.

Versailles.

British Museum.

Plate CLXXXI.

France was not hasty in adopting the Roman manner as revived in Italy. It was not till the 17th century, that St Louis de la Rue St Antoine was constructed from a design executed at Rome by Vignola, the front and cupola of the Invalids by Mansart, and St Genevieve, (now the pantheon,) with its magnificent portico, by Soufflet, are reckoned the best specimens. The south-east front of the old Louvre by Claude Perrault, consisting of a colonnade of the Corinthian order 400 feet in length, possesses great simplicity, and produces a noble effect. The gallery of the Thuilleries 1300 feet in length, is uncommon and striking. The observatory is grand and imposing; and the fountain Grenelle is very beautiful. The palace at Versailles is more remarkable for its magnitude than good taste; there is a great monotony in it, and the ornaments are trifling and crowded. The British museum, built upon the model of French palaces, by Monsieur Pouget, is an evidence, that the roof is much too predominating a feature. See Plate CLXXXI.

Fischers.

In Germany, this Roman style made no progress. Even at Vienna, in the church of St Charles Borromeo, the best work of John Bernard Fischers, there is little merit. In the church of the imperial convent at Molck in Austria, he has been more successful. See Dallaway, *Observ.*

Holbein in England.

Towards the middle of the 16th century, and near the close of the reign of Henry the VIII. Holbein introduced Roman architecture into England; but his labours did not extend beyond porticos and portals. St James's palace in Westminster, opposite to Whitehall, and Wilton house, contained specimens of his works.

John of Padua.

After him, John of Padua built the palace of the Protector Somerset on the bank of the river Thames,

Longleat.
PLATE CLXXVIII.
Inigo Jones
erects edifices in Denmark and Scotland.
Heriot's hospital.
St John's college, Oxford.
Greenwich hospital.
Covent Garden church.
Castle Ashly.
Coleshill.

between the cities of London and Westminster. He also built Longleat in Wiltshire, wherein are introduced the Doric, Ionic, and Corinthian orders immediately over each other, which formed a very regular and magnificent edifice, (See Plate CLXXVIII.) But it was not until the beginning of the 17th century, that the practice of this style was completely established by Inigo Jones. He was born in London in 1572, and having early shewn a strong disposition for drawing, he was, by the munificence of the Earl of Pembroke, enabled to travel through Italy. Here the remains of the ancient edifices, the magnificent works of modern architecture at Rome, but above all those of Palladio, afforded a field for study, upon which he entered with ardour, and benefited to such a degree, as to enable him to become the Palladio of his native country. From Rome he went to Denmark, at the request of Christian IV. where he was found by James I. and was brought over to Scotland by Queen Anne. Here he altered and improved the old palace of Holyrood House, and afterwards gave designs for Heriot's hospital, and probably the parliament house. In 1612 he returned to Italy, and finished his studies. Of his early and least classical style, the inner quadrangle of St John's college, Oxford, is a specimen. Here the arches rest immediately upon the capitals of the columns. There are busts between the arches, and heavy wreaths of foliage in the alcoves. But he afterwards composed, with simplicity and great classical elegance, the banqueting house Whitehall, Greenwich Hospital, Surgeon's Hall, and Covent Garden church. Besides these public works, Wilton house, the south and east side of Castle Ashley, Lord Radnor's at Coleshill in Berkshire, and Stoke Park in Northamptonshire, are known to be his. But his practice having been very extensive, many other edifices are in part his, and formed upon his models. So that, besides the classical elegance which he introduced into public buildings, we are equally indebted to him for the convenience and comfort enjoyed in the private dwellings which he planned.

Chris-[illegible]

Next in succession to Inigo Jones, is Sir Christopher Wren. He was eminently possessed of the qualifications requisite for a perfect architect; his education was liberal; he was one of the first geometricians of the age in which he lived; he had a disposition for mechanics; he possessed a dispassionate but persevering temper, and had a fine taste.

St Paul's.
PLATE CLXXIV.

We have heard of few architects, either ancient or modern, in whom all these requisites were so perfectly united. He was of Wadham college Oxford, and became Savilian professor of astronomy in that university. Having given various excellent specimens of his architectural talents in that beautiful city, he was appointed a commissioner for repairing St Paul's church in London. In 1665, he travelled into France, to examine the public buildings of that nation. After the great fire of 1666, he was fixed upon to form the plan, and direct the rebuilding of St Paul's. This he accomplished in the course of 35 years, and has produced an edifice, of which his country has reason to be proud. (See Plate CLXXIV.) The extreme length is 530 feet, breadth 250, height 366, breadth of façade 180, outward diameter of the cupola 140, inward at whispering gallery 112 feet. The original and favourite design of the architect was not adopted by the commissioners. It, in many respects, possessed more magnificent features than the present. Instead of two it consisted of one order only, and the portico was very considerably insulated. Every part had by this means much more simplicity, elevation, and boldness, and there being only a single range of large windows, it conveyed the idea of one great apartment. Internally, the dome rested upon the entablature of the order, without the intervention of arches. Plates of this design have been published, and a model of it is still preserved in an apartment of the present edifice.

St Stephen's, Walbrook.
PLATE CLXXV.
St Mary le Bow.
Monument.

The devastation caused by the great fire of 1666, afforded many other opportunities for his architectural talents. In the church of St Stephen's, Walbrook, there is a most perfect specimen of his skill, (see Plate CLXXV.) It consists internally of a cupola, resting upon Corinthian columns; the whole distributed and adjusted with the utmost delicacy and correctness. Many of the other churches of the city owe their most distinguishing features to his masterly hand. The tower of St Mary le Bow is a singular and bold ornament for a great city. In the monument, he has constructed a column equal in design and execution, and superior in elevation, to any of antiquity: if his material is inferior, or the sculptures less numerous, prudence and necessity limited his exertions. The height of this column is 202 feet; that of Antonine, at Rome, was 175; and that of Trajan only 147.

Greenwich hospital.

The other works of this great architect are numerous. The parts he planned in Greenwich Hospital are inferior to few edifices, ancient or modern. The colonnades, of 347 feet in length, will bear a comparison with those of Bernini, in front of St Peter's.

Trinity college Cambridge.

Chelsea Hospital, and the modern part of Hampton Court, though chiefly of brick, are yet magnificent buildings. And the garden front and chapel of Trinity College, Cambridge; the Ashmolean Museum, and Sheldonian Theatre, at Oxford, besides many lesser works, will perpetuate his fame in that singularly fine city.

Gibbs.
St Martin's in the Fields.
Radcliffe library.

In the works of Sir C. Wren, the Roman manner was completely established; the Gothic was totally rejected, and branded with terms of contempt. The public buildings were afterwards all designed in this newly adopted style; and, for some time, Gibbs appears to have been most extensively employed in the management of many of them. He was a scrupulous copyist of Palladio, but he seldom displayed good taste. In the London churches, of St Martin's in the Fields, the New Church in the Strand, and St George's, Hanover Square, he had ample opportunities of displaying talents; but it is only in St Martin's that any degree of merit can be allowed him: there the single Corinthian order, carried up the whole height, and quite around the church, is simple and correct; and the portico is the only one in London, which conveys any idea of that of the pantheon at Rome; but the two rows of rusticated windows destroy simplicity, and greatly injure the general appearance. The portico of St George's, Hanover Square, wants depth; and the New Church in the Strand is frittered into trifling parts, and covered with tawdry ornaments. In the Radcliffe Library, at Oxford, there is much to blame; the cupola seems to have sunk from its intended situation, and the doors and windows are in a worse style than those of St Martin's. So completely was the Gothic style by this time supplanted by the Palladian, that Gibbs attached a church, designed in the latter style, to a very fine Gothic tower, in the town of Derby. He published a volume of designs in 1728.

Sir John Vanburgh.
Blenheim house.
PLATE CLXXIX.

About the same time with Gibbs, Sir John Vanburgh practised architecture extensively in England; but although the works he executed were all palaces and for nobles, yet, being for private persons, it is Blenheim alone which can be admitted in the list of public edifices. The style of this splendid palace, (see Plate CLXXIX.) erected at the public expence early in the 18th century, displays much boldness and originality of genius. The diversity and novelty of the outlines, both in the plan and elevation, form a strong contrast with the tameness of other buildings. The whole façade has more the appearance of a triumphal monument, than a private dwelling. His poetical mind, independent of previous canons, imagined forms expressive of the character he had assumed; and certainly, in what regards general outlines, and the disposition of the principal members, few architectural works have so completely succeeded; but in the subordinate features, his taste has been grossly deficient; and it is difficult to conceive, how talents like his could admit the rude clumsiness which but too frequently deforms his buildings. The central front of Blenheim is scarcely a sufficient mass for the wings.

Sir W. Chambers.

In the conduct of great public works, the next architect was Sir William Chambers. He has displayed a strong disposition to investigate subjects connected with architecture. He took much pains to acquire a knowledge of the Chinese mode of building and gardening. On this subject he published a treatise, and produced specimens in the king's gardens at Kew. He bestowed still more attention upon the Roman style; and, in his Treatise on Civil Architecture, he has, with great care, made a judicious selection from the purest remains of antiquity in Italy, and from the works of its ablest restorers. He was so totally ignorant of Greek architecture, as to dispute its being carried to much perfection, or practised on a large scale by that people. His situation, as surveyor-general of the board of works, led him to be employed in edifices, where there was abundant opportunities of displaying his talents.

Somerset Place.

The square of Somerset Place is entirely from his designs, and executed under his direction. Its situation on the banks of the Thames is favourable, for being viewed from the middle of the river, or Westminster Bridge. Towards the street, the front, which is on a line with the houses on each side of it, is seen to disadvantage. The inside of the square has all the advantages a similar space can afford. The whole design has not been completed, but the central part has; and we therefore see what must have been intended as the principal features of the composition. In the river front, there is a fine terrace; but the extensive façade, which is elevated upon it, is deficient in majesty. The disproportioned height of the basement takes away from the effect of the order. In the dark recesses, the columns appear very diminutive. If the basement had been only so high above the terrace, as to raise the order to be all seen from the middle of the river, the parts would have been more distinct and impressive; and had the face of the building been plain, instead of being wholly cut into small rustics, there would have been more simplicity. The dome in the centre of the roof is much too small. The small extent of the street front renders the improper height of the basement more conspicuous; and the whole is rather crowded than grand. Within the square, which is 300 feet north and south, and 200 east and west, there is a tiresome repetition of rustic work: there are many fine door-cases and windows, and much exquisite sculpture; but as a great design, it is deficient in the magnificence which a national edifice of this description ought to possess. The interior of the building is arranged with much care; and it has several fine staircases. This architect appears to have been careful and persevering, and endeavouring correctly to follow what he conceived the true classical style; but he was ignorant of, or despised Greek architecture, and seems to have been deficient in original genius and taste. He died in 1796.

Adam.

About this time, Robert Adam also rose to much eminence as an architect: in many respects, he appears to have been the reverse of Sir William Chambers. He early travelled into Italy; and probably from a desire of distinguishing himself, by introducing a subject untouched by former students, he, with much assiduity and care, made accurate measurements and drawings of the once splendid palace of the Emperor Dioclesian, at Spalatro in Dalmatia: these he published, with finely engraved plates, in one folio volume in 1764. He designed the buildings called the Adelphi, and, in conjunction with his two brothers, conducted the erection of them; although composing a series of private houses, yet as a piece of street architecture, or façade to the river, the Adelphi becomes a public building.

Adelphi.

From the river the effect is very imposing. Economy rendered it necessary to build with brick, instead of Portland stone, and to make the ornamental parts of a composition which he invented. Being of less extent than Somerset House, it acquires more apparent elevation and lightness. The outlines of the tall pilasters, in the centre building and wings, add very much to this effect, while the long horizontal lines of light frieze and cornice preserve great simplicity; but perhaps the most striking feature is, the appearance of the whole mass standing upon the dark caverns, formed by arcades under the terrace, and the arched passages which lead from the wharfs on the shore up to the street called the Strand. The desire of converting as much as possible of the space into buildings, has made the streets of the Adelphi too narrow. This is both inconvenient and unpleasant. Towards the Strand the architecture is disfigured by circles, and a profusion of unnecessary and minute ornaments. In this instance, as well as in many of his designs for individuals, it appears, that his fertile mind had been unfortunately too strongly infected by the luxuriant, but depraved style of Dioclesian's palace. The Register Office at Edinburgh will be noticed in the Architecture of Scotland; and his other numerous and masterly works will be noticed under the Section of DOMESTIC ARCHITECTURE and that of SCOTLAND. He died in 1792.

But previous to the publication of Mr Adam's drawings, England had been instructed and astonished by the most splendid phenomenon which the Roman school ever exhibited: We here refer to the ruins of Palmyra and Balbec, which Messrs Dawkins and Wood visited in 1751, and published descriptions of in 1753 and 1757. The particulars respecting the architecture of these extraordinary edifices, will be presented in considerable detail under the head of Practice; but we consider it only as justice to the memory of Mr Dawkin's, here to observe,

Mr Dawkin's munificence.

that the whole expence attending the journey, draftsmen, engravers, and publications, was defrayed by him, without any view of participation in the returns made by the publications, which were very considerable, but which he generously assigned to his colleague Mr Wood: And, what is perhaps equally deserving of admiration, was his indefatigable attention to the measurements on the spot, and afterwards to their being accurately represented in the engravings; to the truth of which the writer of this article is enabled to bear witness, by the kindness of his nephew James Dawkins, Esq. M. P. in whose possession the beautiful original drawings now are; and who, with his uncle's liberality of disposition, inherits his taste for the fine arts. From that gentleman we also learn, that Britain had nearly been deprived of these architectural treasures, by the Italian architect who had been employed as a draftsman. This person, though inimitably expert as an artist, was so unprincipled as to abscond with all

Situation of Palmyra.

History.

the finished drawings. By immediate and active pursuit, those relating to the architectural parts were all recovered; but twenty-six finely executed landscapes in Egypt, Greece, and Asia Minor, were, only a few years ago, accidentally discovered and purchased by the present Mr Dawkins, in a public auction room in London. From the publications of Messrs Dawkins and Wood, we learn, that Palmyra is situated in the middle of a sandy desart, 203 miles from the Mediterranean, 176 from Damascus, and 333 from Seleucia: That it had risen to great splendour in the time of Zenobia, when it was taken and much injured by the Roman emperor Aurelian, who ordered Ceionius Bassus to repair the temple of the Sun, with the value of the gold and jewels found in Zenobia's possession. It appears by an inscription copied by our travellers, that Dioclesian erected a considerable edifice at Palmyra, under the charge of Hierocles; but that no inscription was discovered older than the Christian æra, nor any later than Justinian; that the eldest have Palmyrean names, and the latter Roman prænomina; that, with the exception of two Ionic semi-columns at each end of the cell of the temple of the Sun, and two in one mausoleum, the whole of the architecture has been of the Corinthian order, highly decorated; and that, with the exception of four granite pillars in the middle of the long portico, the whole was composed of white marble.

Balbec.

The temple of the Sun at Balbec, of uncommon magnitude and splendour, appears to have been built under that excellent Roman emperor Ælius Antoninus Pius, near Libanus in Phœnicia, at a resting place between Tyre and Palmyra.

Messrs Stuart and Revet.

Ionian Antiquities.

Greenwich chapel.

It was a singular circumstance, that, until the time of Messrs Stuart and Revet in 1751, there had been no recourse to the school from whence the Romans derived all their knowledge of architecture. The indefatigable and faithful labours of these deserving artists, who were also supported chiefly by the munificence of Mr Dawkins, furnished correct plans and profiles of many magnificent and beautiful remains in Attica, and other parts of Greece. This undertaking occupied four years, during three of which they resided chiefly in Athens. Nothing can exceed the accuracy of their measurements and delineations; and their work put England for the first time in possession of Grecian architecture. By comparing these specimens with those copied from the best Roman works, it is evident how much architecture had suffered in the hands of the rude conquerors of the world. The correct simplicity, bold features, and delicate proportions of the Greek architecture, display the superiority of genius and taste of that extraordinary people. Stuart's Antiquities of Athens was followed by a similar work upon those of Ionia, delineated with equal judgment and care by Messrs Revet and Pars, who returned in 1766 from a journey made by the direction and at the expence of the Dilettanti Society, and which has secured to us the taste and manner of the refined inhabitants of Ionia. These works, and the buildings erected under the direction of Mr Stuart, have produced a considerable change in the architecture of this country. The restoration of the chapel of Greenwich Hospital, is a fine display of the application of the Greek style.

Wyatt.

Pantheon, Oxford Street.

Oriel College, Oxford.

Gateway. Canterbury Court, Oxford.

After the introduction of pure Greek architecture, it has been fortunate that an architect (Mr Wyatt) has risen to eminence, whose taste exceeds in correctness that of his predecessors. The work which at once displayed his talents, and introduced him to extensive employment, the Pantheon, falls under the head of those for public amusements. In the front of the library of Oriel college in Oxford, he has given a correct Ionic; but even here the basement is too high for the order it supports, and the ornamental superstructure is too evidently restricted to the front only. It is a fine screen set up against a building, of which it does not appear to form a component part, which it might have been rendered, by employing a pilaster instead of a column, and break at each extremity. His Doric gateway to Canterbury court, though not purely Greek, is a fine instance of the beautiful simplicity of that order. When compared to the Greek, the columns appear too slender, and the alternate square and circular tablets, recesses, and niches, do but imperfectly harmonize with the gravity of the Doric. Mr Wyatt has been very extensively employed in repairing and restoring many Gothic cathedrals, although he has been, in some instances, accused of not being sufficiently correct in keeping distinct the different orders of this school. He has, in general, succeeded admirably well in preserving the spirit of the originals. The public are much indebted to him, not only for what he has himself performed, but for proving, that these fine structures may be preserved to posterity.

Legislation.

Edifices for the purposes of legislation.

Court of Westminster.

St Stephen's Chapel.

Buildings for the purposes of legislation and the distribution of justice, in the time of the Greeks and Romans, were known by the name of the forum and basilicæ. In England, they are distinguished by the names of senate-house, courts of justice, jails, and bridewells. The national senate-house of these kingdoms is situated in the old palace of Westminster, erected by Edward the Confessor, to which William Rufus added the great hall as an appendage. The hall was rebuilt by Richard II. in 1397, and is 270 feet in length, and 74 in breadth. The apartment called the House of Commons was originally a chapel built by king Stephen, and dedicated to St Stephen the martyr. It was rebuilt by Edward III. in 1347. There is little architectural merit in those edifices, yet, notwithstanding this, the features of antiquity which every way present themselves, associated with the scenes they have witnessed, create a solemnity, and inspire a respect, which more modern and regular architecture would probably fail to command. The courts of justice, though apparently confined, and externally fitted up with bad taste, derive much dignity from the magnificent hall in which they are placed, and it also affords much real conveniency to the concourse of people, whom business frequently obliges to attend upon the courts. It answers the same purposes as the extensive porticos of the Greeks and Romans, and is much more suitable to this climate.

Guildhall.

Newgate.

In the city of London, excepting the great apartment of Guildhall, which is 155 feet long, 42 broad, and 55 high, and the façade of the building by Mr Dance, all that is connected with the courts is disgracefully mean and inconvenient. The prison of Newgate is, in external appearance, a specimen of architecture well adapted to its purposes; but there are several ornaments sunk into recesses in the rough rustic façade, which might be spared.

Provincial courts of justice, &c.

In many counties of England, much attention has been paid to the construction of courts of justice, jails, and bridewells. In some of them, a very considerable degree of architectural skill has been displayed. The most perfect are those, where the situation and other circumstances admit of their being constructed adjacent to, and so as to communicate with each other, yet are partially accessible, and have a sufficiency of light and air. In many parts of England these buildings, although cir-

John Howard.

cumstances did not admit of their being immediately connected, are yet each of them excellent. It has been chiefly owing to the unwearied exertions of the benevolent John Howard, that so speedy and effectual a renovation of the jails and bridewells has taken place. So far as regards the buildings, his leading principles were, providing accommodation for different classes of prisoners, having separate sleeping cells, also opportunity for solitary confinement, with sufficient ventilation, plentiful supplies of water, and the means of complete inspection. These general principles appear applicable to all countries, and if judiciously employed, greatly ameliorate the situation of the prisoner, accomplishing at the same time, all that is requisite for the purposes of security, punishment, and reformation.

Mansion house, London.

The mansion-house of London, forming the residence, and containing the court of the first magistrate of a city, which for population, wealth, enterprise, accommodation, and perfect arrangement, has seldom if ever been equalled, falls with propriety under this head. Its portico is bold and striking, and, though some of its features are sufficiently clumsy, yet, as a whole, it is grand and impressive, and reflects credit upon its architect, the father and predecessor in office of the present ingenious city architect Mr Dance. It has been reproached with heaviness; but we should be sorry to commit its renovation into the hands of such architects as designed the Bank. It was begun in 1739, and completed in 1753.

India house.

As the hall and office of the managers of the affairs of an extensive, populous, and rich empire, the India house falls also under the description of an edifice for the purposes of legislation. Its north front possesses more chastity of design, than most public buildings of modern construction. There is no break in it excepting that made by a very fine portico, consisting of six Ionic columns, occupying the whole height of the structure, and ornamented with excellent sculpture by the hand of Bacon. Had the upper row of windows been of greater size, they would have added to the dignity of the building, and lessened the space of dead wall which is over them; as it is, having only a range of light level cornices, and the face of the wall being quite plain, the effect is good.

Public Exercises and Amusements.

Public exercises and amusements.

Amongst the Greeks and Romans, their exercises and amusements had their origin chiefly in the preparation of their youth for the modes of combat which were then practised, and in the general interest taken by the rest of the people in the performances of their children and relations. These early grew into habits, and of course became a gratification. Legislators perceived their importance, and determined their order by fixed regulations. We are informed, that the first gymnasium was found amongst the severe Spartans. They were afterwards established in every district of Greece. The Olympic games became the general rendezvous, and common bond of union amongst all the states of Greece. At Rome, the games of the circus were said to have been instituted by Evander, and re-established by Romulus in an island of the Tiber. Both Greece and Rome had the additions of theatres. Amongst the Romans, these edifices were expanded to a prodigious capacity, and, in the hands of artful and worthless men, became the means of debauching the degenerate offspring of that once simple and irresistible people.

Theatre.

In modern times, the mode of warfare being so completely changed, as to render superiority of mind of more consequence than the mere athletic force of body, the exercises which were calculated chiefly for the improvement of the latter, have long ago ceased to be in estimation to demand purpose establishments. The amusements of the theatre have, however, been carried to a degree of refinement unknown to the ancients, and, in an architectural point of view, have become sufficiently important to require a separate article. The amusements of the ancients cannot, with propriety, be separated from those of the moderns; so that we must, for further information, refer our readers to the article THEATRE, under which the several edifices adapted to these purposes will be noticed at considerable length.

Domestic Architecture.

Domestic architecture.

General observations.

In considering the art of building, as adapted to the purposes of domestic life, it is necessary to advert not only to the climate, and general manners, but also to the several gradations of society in which individuals are placed. In England, we have the prince, the noble, the smaller land-owner, the freeholder, the cottager, the merchant, manufacturer, and mechanic, and others who are engaged in the church, physic, and law. But the peculiarities which arise from public offices, or from different professions or occupations, must be treated of under separate heads; here we can only regard the accommodation of their families.

Chinese.

In external appearance, internal arrangement, and also decoration, the dwelling of the prince ought to be suitable to his superior situation; the habitation of the noble will also be in some measure modelled by his rank and duties; and that of others, as their possession of wealth enables them to enjoy profusion, or confines them to the mere necessaries of life. National habits and manners also, greatly affect the domestic architecture of a country. In China, where there is no hereditary rank, there is little appearance of distinction in their houses, excepting in the dwellings of public officers; and the houses of those officers, and even the palaces of the emperor, are insignificant, when compared with the extent and riches of the empire. Amongst the Greeks, while the utmost efforts of fine architecture were exerted upon temples and other public edifices, the private dwellings were generally plain and mean. Yet from the plan of a Greek villa given by Palladio from Vitruvius, (see Plate CLXI.) it appears that a considerable degree of magnificence had at last been introduced; but we have no account of the period when this change took place.

Greeks. PLATE CLXI.

Romans.

Until near the termination of the Roman republic, the utmost simplicity was preserved both in their public buildings and private dwellings; but immediately on the influx of Asiatic wealth, both were carried to an extreme of magnificence. The tribute and plunder of the extensive provinces centering in Italy, the villas of the principal Romans, much exceeded in number, extent, and splendour, all others in the world. The plan given by Vitruvius, (see Plate CLXI.) will convey an idea of their arrangement, and shew, that the palaces of modern princes will suffer by being compared with them.

PLATE CLXI.

This unbounded luxury being created and supported by the tribute and plunder of the richest provinces of the empire, could only exist while these were kept in subjection, or were ruined, and they were accordingly in the end totally destroyed with their degenerate possessors, by the different barbarous hordes which overwhelmed the empire.

Goths, Vandals.

For many ages after the destruction of the Roman empire by the Goths, Vandals, and Mahometan Arabs, the private dwellings of the conquerors were extremely mean: being scarcely advanced beyond the shepherd state, they set little value upon fixed habitations. It

Baron's castle.

was not until the whole of Europe was overrun, and the various tribes had settled upon and begun to cultivate different districts, that permanent habitations became an object of attention. The feuds between neighbouring tribes, and the attempts of fresh swarms to dispossess those already settled and partly civilized, led to the construction of places of strength; and these were contrived, not only to lodge the chief and his immediate dependants, but also to afford protection for cattle and effects in cases of violent attack. The forms of the earliest being very little calculated for domestic purposes, were probably at first only resorted to occasionally, but they in time became the never-failing appendages of every great lordship, and the constant habitation of the baron's family.

Britain.

In Britain, the Saxons most probably preserved and made use of fortresses which had been constructed by the Romans; and it is certain, that King Alfred, after having expelled the Danes, caused many towers to be erected: But it was the Norman conquest which completely covered England with fortified castles upon an improved plan.

Norman fortress.

Rochester castle.

The leading features of a Norman fortress, were a lofty mound of earth encompassed by a very deep ditch. From the summit of the mound rose either a square tower of several stories, or a circular one, which was lower, and of greater diameter. They were usually approached by means of very steep stone stairs on the outside. Other material parts were, the gateway or entrance tower, and the barbican or watch-tower, both of which had a communication with the keep. Most of the keeps had four stories. In the souterain, vaulted with stone, the military engines and stores were deposited. In the walls were placed the winding staircase, the well for water, the large oven, inclosed galleries and chimnies, with an aperture open to the sky, which communicated to the donjon all the light and air it enjoyed: There was also a flue, not more than eight inches diameter, for conveying sound to every part. The state apartment occupied the whole of the third story; and the staircases leading to it were commodious, and sometimes sufficiently large to admit of military engines. Adjoining the great chamber was an oratory, lighted by a large window. At Rochester Castle, in the ground-floor, there was no light, loop-holes only were allowed in the second, but in the third were three large round-headed arched windows, placed so high as not to be looked through, and so defended by an internal arcade, that no missile weapon could enter or fall with effect. Each floor had communication with the well. The chimnies were capacious, and projected into the room, resting upon small pillars; and the sinks were contrived in an oblique direction, so that no weapon could enter through them.

Gundulph.

Gundulph, bishop of Rochester, was the most eminent castle architect after the conquest. In the Towers of London and Rochester he left models of that sort of architecture. During the reign of Henry II. additions were made to the second ballium, the barbican, and entrance tower; and in these the baron and his family usually resided, having recourse to the keep only during a siege.

Castles under Edward I.

Conway.

Caernarvon.

More extended and improved plans were introduced by Edward I. on his return from the crusade, after having seen the castles and fortified cities of the Levant and Holy Land. Conway, in North Wales, affords an example of a fortified town, castle, and palace, being imitated. Caernarvon of a castle and palace only. Edward III. having rendered Windsor a magnificent habitation, was imitated by many of his barons; and, during the contentions of the houses of York and Lancaster, these fortified dwellings were rendered peculiarly grand, by the projecting turrets which were placed at the salient angles, and the hanging galleries which were constructed over the gateways. These castles and their outworks frequently occupied several acres of ground. The court was very spacious; and the halls and state chambers had windows of a magnitude and form similar to those in churches.

Ragland, Thornbury.

During the reigns of Henry the Seventh and Eighth, houses presenting somewhat of a military appearance, but adapted chiefly for private dwellings, were constructed: Of this kind were Ragland in Monmouthshire, and Thornbury in Gloucestershire. And there were others of a still less military appearance, as Richmond and Nonsuch, Hampton Court and Whitehall.

Windsor, Warwick, Arundel, Alnwick.

Some idea of the magnificence of those castles may be formed, by examining Windsor, Warwick, Arundel, and Alnwick. And the effect will be nearer the truth, by recollecting, that, in those times, the immediate retainers were very numerous; and that each great castle was the resort of many dependent lords. Magnificence and profusion were their chief characteristics. The revenues of large possessions were wholly consumed in feeding, feasting, and lodging the dependents of the great barons. But when the contentions of the great were extinguished, the habits and manners changed, and dwellings were adapted wholly to domestic purposes.

Revival of Roman style.

Holbein.

John of Padua.

Plate CLXXVIII.

Previous to this time, the Roman manner had been revived in Italy; and by Palladio, and others in that country, applied with success to private dwellings. The first rudiments of it were introduced into England by Holbein, but he was confined chiefly to portals and porticos; as in that which was once in Westminster opposite to Whitehall, also at St James's and Wilton House. After him followed John of Padua, who built the palace of the Protector Somerset in a mixed style. He also furnished the plan of Long Leate (see Plate CLXXVIII.) in Wiltshire, for Sir John Thynne, secretary to the protector. At Long Leate, the elevation is composed of the Doric, Ionic, and Corinthian orders, crowned with a ballustrade.

Holland House.

John Thorpe.

Holland House, and that of the Marquis of Salisbury at Hatfield, are perfect specimens of the style which prevailed during the time of Elizabeth and James I. The characteristics are, very large apartments, galleries of great length, cornices and ceilings heavy and formed into deep compartments, halls frequently occupying the whole height of the house, very large square windows divided by stone mullions, and parapets composed of pediments of various and singular forms. John Thorpe was the most eminent architect of this age: Burleigh House is his design.

Sir H. Wotton.

Inigo Jones.

About this time the attention of the public was attracted by a treatise written by Sir H. Wotton, upon the excellence of the Roman style as revived by Palladio; and Inigo Jones succeeded in introducing it into private as well as public edifices. From his genius and taste we have not only derived the Roman style, but, what is of more real importance, the convenience and comfort which distinguishes English dwellings. The Queen's House in Greenwich Park, Lindsay House in Lincoln's-Inn-Fields, the east and south sides of Castle Ashbey, Lord Radnor's House at Coleshill, Berks, Stoke Park in Northamptonshire, and the Grange in Hants, are known to be from his designs.

Sir C. Wren.

Although Sir C. Wren was chiefly employed in public works, yet Hampton Court, Winchester Palace, and that designed for St James's Park, prove, that his classical taste and scientific skill were equally eminent in every department of his art.

Sir John Vanburgh.

Plate CLXXIX.

The next architect of eminence was Sir John Vanburgh, whose chief works are, Blenheim, (see Plate CLXXIX.) Castle Howard, Grimsthorpe, Seaton Delaval, and King's Weston. In all these splendid edifices there is much genius displayed, and in all of them the architect of Blenheim is distinctly to be traced. He was too much a mannerist. In the smaller buildings his defects are more conspicuous; and his heavy arches, clumsy arch stones, and glaring semicircles, are in many instances unpardonable and disgusting; but from this heavy charge there are some exceptions, as in the fine garden front of Castle Howard.

Interior of houses noticed.

The interior of the houses at this time were too much sacrificed to great halls, staircases, and galleries. These commonly occupied about one-third part of the principal edifice, and rendered the other two divisions cold and uncomfortable.

Earl of Burlington.

The Earl of Burlington, at his houses in Piccadilly and at Chiswick, produced beautiful specimens of Palladian architecture. Holkam and Houghton, in Norfolk, are magificent edifices, but partake, perhaps, too much of the French style. Wanstead, in Essex, by Colin Campbell, has more architectural merit. Stowe, in Buckinghamshire, is a splendid monument of the taste of Viscount Cobham and Lord Camelford; and Wentworth, in Yorkshire, reflects equal credit upon William, Earl of Strafford. These, and many other habitations, show the perfection to which domestic architecture was carried in England. The estimation in which it was then held, is evident from considering, that not only men of the first talents and taste, but noblemen of the first rank in the kingdom, both encouraged and practised it.

Colin Campbell.

Hitherto the restored Roman architecture had been formed entirely upon that furnished by the modern Italian architects, and was frequently employed without just discrimination as to the different characters of the buildings. This led to the introduction into apartments of delicacy, decorations which the ancients had only used in those of great dignity and magnitude. But about this time, some very ingenious artists of this country, not satisfied with this translation of taste, were prompted to examine the ruins of those ancient edifices where architecture might be found in the greatest purity and splendour. With this view, Messrs Wood and Dawkins visited Balbec and Palmyra; Stuart and Revet, Greece and the coast of Ionia; and Robert Adam, the Emperor Dioclesian's palace at Spalatro in Dalmatia. In order effectually to accomplish the objects of their missions, they not only ascertained the outlines of the several buildings, which they examined by actual measurement, but they determined the precise dimensions of each particular member and decoration. They each of them published, in a splendid style, the result of their labours, which furnished the rudiments of a new school, drawn immediately from the most refined works of the ancients.

Dawkins and Wood.

Stuart.

R. Adam.

Works by Adam.

Plate CLXXX.

Mr Adam, on his return to England, was for many years very extensively employed, and thereby had many opportunities of adorning his country with edifices constructed upon the principles of this newly acquired manner. Keddlestone in Derbyshire, Luton Park in Bedfordshire, (see Plate CLXXX.) Kenwood in Middlesex, and Shelburne House in London, reflect much credit on his genius and taste. In these works, the refined style of the ancients is introduced with great propriety, and the decorations are applied with a delicacy which was before unknown. But the Palace of Dioclesian, which formed the principal object of his study, was decorated to profusion, and was, upon the whole, an instance of the bad style into which the Romans had degenerated. His manner accordingly partakes too much of this original: His decorations, though exquisitely fine, are frequently too profuse; and many particular features accord ill with the outlines of correct Greek architecture. The street architecture of the Adelphi, and the gateway to Sion House, are instances of these defects.

The defects in Mr Adam's style were corrected by that brought from Greece by Athenian Stuart: It was now, for the first time, that architecture, as practised by the Greeks, appeared in original purity. The beautiful simplicity of the outlines, the correct propriety of the particular members, and the strict delicacy of every ornamental decoration, display the superior taste of that singular people. Besides his classical performance in the restoration of Greenwich Hospital, Mr Stuart designed the house of Mr Anson in St James's Square, and of Mrs Montague in Portman Square.

During this time, Sir William Chambers was very extensively employed as an architect. He was correct in the best Roman manner, and appears to have been constantly labouring to obtain a stiff magnificence. The Villa of Lord Besborough, and Lord Abercorn's house at Duddingston, near Edinburgh, are some of his best works.

Carr of York.

In the north of England, the late Mr Carr of York practised architecture very extensively, and in many works of considerable magnitude. Harewood House is inferior to few of the dwellings of the nobility, and is a respectable specimen of his professional skill. He holds a middle place between the stiffness of the preceding style and the variety which has lately succeeded. He is rather a mannerist, with a repetition of the extended fronts.

James Wyatt.

Plate CLXXX.

To the credit of the national taste, the Greek style has lately obtained a decided ascendency in every part of the kingdom, and the present artists have, in many instances, cultivated it with success. It is also fortunate, that Mr Wyatt, who has long been at the head of his profession as an architect, possesses sufficient taste and skill to distinguish the true beauties of his art under whatever school it is to be practised. He appears to be equally aware of the excellence of the Greek, Roman, or Gothic manners, and likewise equally successful in applying them in public edifices and private dwellings. We are sorry that our prescribed limits will not permit us to give more than two specimens of his works, (see Plate CLXXX.) but they are mostly well known, and easy of access to English artists.

General remarks.

The great influx and general diffusion of wealth, has of late introduced an improved domestic architecture in Britain. The merchants and manufacturers have, by their superior industry and ingenuity, acquired, most honourably, the means of procuring accommodation equal to that of our nobility. This demand has increased the number and dexterity of our architects, many of whom exercise their profession with much credit and skill; but our views being confined to merely carrying on a connected account of the progressive changes of the art, we must deny ourselves the pleasure of bestowing encomiums upon many deserving artists, and conclude this part of our subject with a few general reflections.

For more than a century past, whatever peculiarity

Mode of arrangement improved.

Thoroughfare apartments avoided.

Bells and water closets adopted.

prevailed in the style of external or internal decorations, the mode of arranging the apartments has been gradually improving. They have been more judiciously adapted to the nature of the climate and the circumstances of the possessor; convenience and comfort have been made the chief objects; and these have, we are convinced, been obtained to a degree of perfection unequalled in any other country. The contracting the dimensions of unnecessarily large halls and staircases, avoiding long passages, preventing the necessity of having rooms thoroughfares, the introduction of bells and water closets, and the more perfect supply and distribution of water, may be reckoned amongst the chief of these improvements.

Rejecting wings a defect.

One variation, which has lately taken place, seems rather to have interfered with domestic conveniency, and has even considerably injured external appearance,—we refer to the rejection of inferior buildings as wings. The elevation now consisting of one mass of principal building, if the local situation does not admit of having concealed offices attached immediately behind, they must either be placed in the sunk part of the main building, or at a distance from it—both of which modes are very objectionable in a country residence. On the other hand, the proper distribution of inferior buildings, as wings, afford many domestic conveniences, and also enable the architect to vary, more successfully, the outlines of his front. But this part of the subject will be treated of more at length under the Practice of Architecture.

In England, principal mansions are built upon estates.

The foregoing brief survey and observations will serve to give a general idea of the progress of domestic architecture in this country. In other countries, the climates and habits of life have created a difference in style; but as on the continent the palaces of the nobility are chiefly confined to the cities, the country residences have not been an equally important object of attention, as in England, where the chief family residences have ever been upon the estates. We have already stated, that the villas of the ancient Romans were of great extent; and if the delineations in Newton's Vitruvius are correct representations, their magnificence and elegance accorded with their magnitude; but these were the abodes of the princes of the earth, who required for their cellars a space which exceeded that which was occupied by the farm of Cincinnatus. The palaces erected for modern Italians, by Palladio, and the other restorers of the Roman manner, were also extensive and splendid; but these were also to lodge princely prelates in the zenith of the Romish church, or the princely merchants of the Italian seas. They were not the usual domestic architecture of the respective states; and were, besides, of a character ill suited to the British climate and manners.

Commerce.

Commerce.

Buildings employed for commercial and manufacturing purposes, are, in Britain, numerous and extensive. They have, from long experience, and keen emulation, been rendered very perfect for their respective offices; but these offices are so various, and so intimately blended with harbours, ports, and the operations of particular manufactures, that they must, unavoidably, be treated of under these heads. All, therefore, which can, with propriety, be mentioned here, are edifices of a public and general nature; as the exchange, custom-house, and public markets.

Edifices required.

Of the great commercial cities of antiquity, as Athens, Corinth, Tyre, Carthage, and Alexandria, we have detailed accounts only of their wars, wealth, and luxuries. Historians have been captivated by the splendid operations of rich and prosperous states, but have neglected to investigate the nature of the means by which they arrived at consequence and power. They have transmitted detailed accounts of temples, palaces, sculptures, and paintings, but have left us very much in the dark respecting the precise modes in which the business and industry of those great ports were conducted, and also of the nature of the edifices which were appropriated to the purposes of their extensive commerce, and rich and varied manufactures.

Forum.

The ancient markets were known by the name of the forum, and appear also to have included what we denominate exchange and bank. Vitruvius says, that the Greek forum was square, with ambulatories in the upper story; the Roman was oblong, with porticos and shops for bankers, and with galleries in the upper floor adapted for the management of the public revenues. The Roman forum included also many other edifices of a different nature; as the basilicæ, prison, curiæ, and were enriched with colonnades and sculpture. That of Trajan was entered by four triumphal arches, and had his magnificent column in the centre of it. Round the harbour of Carthage, we are informed, that accommodations of every kind were provided for merchants and seamen, and that, being decorated with Ionic columns of marble, the whole had the appearance of magnificent galleries.

Carthage.

Exchange at Amsterdam.

London.

In modern Europe, the Low Countries and England have carried commerce to the greatest extent and perfection, and have constructed exchanges upon very extensive and commodious plans. That at Amsterdam is of an oblong form: it is a plain building, of squared free stone, founded upon 2000 timber piles; it is 250 feet in length, and 140 in breadth; 26 marble columns support its galleries, to which there is access by a spacious staircase. The Royal Exchange of London was first built solely at the expence of Sir Thomas Gresham, in 1567. It was originally named the Bourse, but altered to that of the Royal Exchange by Queen Elizabeth, when she paid a visit to the founder in 1570. Three years after the great fire, it was rebuilt under the auspices of Charles II. at an expence of L. 80,000. The quadrangle occupies a space of 203 by 171 feet. The entrances are at the north and south sides, by two arched gateways. A very commodious arcade, or portico, occupies each side of the quadrangle. The middle space, of 144 feet by 117, is open, and has a statue of Charles II. in the centre. Over the arcades are semicircular groined arches, which spring from the caps of slender columns. In the story over them there are Ionic pilastres and windows, alternated by niches and statues. The whole style resembles the earliest practised by Inigo Jones, in the quadrangle of St John's College, Oxford. The south front is in an equally incorrect style, having very slender piers under heavy arcades supporting the whole superstructure, and two clumsy circular pediments over two Corinthian columns on each side of the entrance gateway. The same bad taste is extended to the tower, consisting of numerous, crowded, trifling parts. The lower parts of the building joining the arcades, are occupied by common shops; but the upper story affords excellent and extensive accommodations for transacting business.

Bank of England.

The Bank buildings, which are near the Exchange, are extensive, and executed in a rich style, but reflect no great credit on our national taste. The south front is composed of highly ornamented and very trifling parts. The north front differs little from a dead wall, with columns and pillars placed where it is difficult to assign them any use.

Liverpool exchange. The Liverpool exchange is, with regard to dimensions and architecture, superior to any other in England. The building originally intended for that purpose, was begun in 1749 from a design of Mr Wood, the ingenious Bath architect. It is a large square building, with a rustic basement, and upon that a magnificent Corinthian order, which is continued around the whole edifice. A range of tablets, enriched with emblems of commerce, occupy the space between the Corinthian capitals; and the pediment, on the centre part of the south front, is also filled with emblematical sculpture in high relief. The general proportions of the whole structure are good, and the execution of the sculpture is masterly. In 1796 the interior was destroyed by fire, but repaired for the town courts and offices, and an elegant cupola and dome constructed, which added to the general effect. The height from the pavement to the centre of the dome is 120 feet. It is remarkable, that this splendid building should never have been used as an exchange, the merchants preferring to meet in the adjacent street. This led to the project of converting an extensive space on the north side of this edifice into a quadrangle of commercial buildings, with arcades. The north façade extends 177 feet 8 inches, and is from the pavement to the top of the attic 62 feet 4 inches high; those on the east and west sides of the quadrangle are each 131 feet in length, and 55 feet 8 inches high. The style of the whole is judiciously made to correspond with that of the old exchange. The façade on the north side has, like it, a break or projection in the middle, upon the rustic basement of which rises a noble portico, consisting of 8 coupled Corinthian columns 25 feet high, each of the columns formed of one stone. On the entablature are placed four emblematical figures. Under this portico there is a vestibule or entrance, divided into three avenues by 32 Doric columns 12¼ feet high, with their proper entablatures, and surmounted by elegant groined arches. The arcades round the three sides are 15 feet wide. The exchange news-room in the east wing is 94 feet 3 inches in length, 51 feet 9 inches in breadth, and in the middle 31 feet 4 inches high. The ceiling is supported by 16 Ionic columns, and over this is a room of similar dimensions, appropriated for underwriters, &c. This quadrangle will be a lasting monument of the spirit and exertions of this enterprizing town, and an excellent specimen of the taste and talents of John Foster, Esq. architect to the corporation, from whose designs and directions it was erected. It was begun in June 1803, and the masonry was completed in about three years.

Bristol exchange. Bristol exchange consists of a small open square piazza, encompassed by an elegant colonnade, which supports a flat ceiling, thrown into compartments by beams, which reach from the columns to the walls; and these having enriched soffits under this part of the edifice sufficiently ornamented, the whole piazza is surrounded by apartments where business is transacted. The street front is in a style somewhat similar to the Liverpool exchange.

OF ARCHITECTURE IN SCOTLAND.

Scotland. The state of architecture in North Britain having been inferior to that in the more extensive and wealthy districts of the southern parts of the island, we have, as much as possible, avoided mixing it with the account of the progress of architecture in England; but the *Edinburgh Encyclopædia* would be accused of an unpardonable remissness, if this part of the subject was left wholly unnoticed: to avoid this imputation, we therefore insert the following sketch.

General observations. While the country was inhabited by small, rude, and nearly independent tribes and clans, and was, at the same time, exposed to incursions of the equally rude tribes from the northern parts of the continent, it is natural to expect, that the chief attention would be bestowed upon places of security, to which they could retire with their families. We accordingly find in Scotland the vestiges of two sorts of buildings apparently of the aforesaid description, whose era and mode of construction has never hitherto been satisfactorily made out by either historians or antiquarians. We here allude to the large circular towers built of rubble stones, laid in a regular manner without mortar, and to those singular structures known by the name of vitrified forts.

Vitrified forts. The vitrified forts are generally situated on high and partly insulated hills, where the space on the summit is occupied by the fortress. They consist of walls or mounds, composed of stones of various kinds and sizes, of irregular forms, without any mortar, but cemented by means of calcined pudding-stone. The interior space inclosed, varies in the several forts from 140 yards in length and 40 in breadth, to 25 yards by 15. In some, there is only one inclosing wall or mound; in others, as Craig Phadrick, there are two, leaving a space of 10 or 12 feet between them. The thickness of the vitrified walls or mounds varies from 7 or 8 feet to 40. **Probable purposes.** These structures being situated to command a great extent of country, and so that there are two within sight of each other, they appear, as well as places of protection, to have been a chain of signals. Craig Phadrick, situated a mile west of Inverness, at the north-eastern extremity of the great Glen of Scotland, upon the point of a ridge projecting considerably before the other parts of the hilly country, and facing the middle of the great bay of the Murray Firth, could readily receive notice of the landing of an enemy upon any point of its extensive shores. This intelligence could be instantly conveyed to Dun Sgrebin on the north side of Loch Ness, and from thence to Dun Jardel on the south side, and from it to Dun Deam near Fort Augustus, and thence to a vitrified fort in Glen Avis near Fort William, and from the latter place down the shores of the Linnhe Loch to the Western Isles, the southern parts of Argyllshire, and the Firth of the Clyde. If an enemy appeared on the western coasts, a similar operation could convey intelligence to Craig Phadrick, from whence it could be forwarded northward to the extensive vitrified fortress of Knock Farril in Ross-shire, and that of the hill of Cruich in Sutherland; and, at the same time, by means of Don Evan and Castle Finlay in Nairnshire, the alarm would be passed along the coast of Murray, and from thence across the valleys of the Don and Dee to the vitrified fort of Finaven in Strathmore, and thus meet the intelligence from the west in the southern parts of Scotland. It is most probable that these signals were made by means of lighting fires of wood, with which there is abundant evidence, that every hill was anciently clothed; and these intense fires, repeatedly placed against these inclosures composed of fusible materials, are considered by Sir Geo. Mackenzie, Bart. (see the article VITRIFIED FORT, which Sir George Mackenzie has had the goodness to draw up for this work,) as quite sufficient to have produced all the vitrification, respecting which, various other theories have of late years been offered. Mr John Williams, a mineral engineer, who, by publishing a Treatise expressly on the subject in 1777, first brought these structures into public notice, is of opinion, that they were constructed by raising two parallel dykes of earth or sod in the direction of the intended wall, with a space between them sufficient for its thickness, where the fuel was put in and set on fire, and upon this the fusible pudding-stone (usually found near

Various opinions.

the spot) being laid, was kept from running off by the aforesaid sod or earthen dykes; and this operation being repeated, the wall was raised to the desired height. Mr A. Fraser Tytler, professor of Civil History in Edinburgh, afterwards Lord Woodhouselee, examined these forts in 1782, and furnished an excellent paper on the subject, which is inserted in the Transactions of the Royal Society of Edinburgh. His opinion is, that the walls or mounds have been built between two rows of wooden stakes, secured together by boughs of trees, having the spaces between these rows filled with stones, earth, and trunks and boughs of trees, and that the vitrification took place during the destruction of the mass by fire. Cordiner considers each fort to be an extinguished volcano, and that the wells found in the inclosures are the craters; but in Craig Phadrick there is no well, and the space upon which the fort is constructed is a mass of undisturbed pudding-stone rock, and it would have been a singular circumstance, to have found small volcanos so conveniently situated for a chain of signals. But setting aside the theories respecting the mode of construction, it is quite certain that vestiges of these rude fortresses now exist, and that they must have been formed by artificial means, to serve the purposes of the inhabitants in a very remote period. In that view, they must be allowed to be works of great magnitude and labour, and they now form a singular feature in the country, and a subject worthy the notice of the antiquary and historian.

Circular towers, or duns.

The circular towers, which are numerous, appear to have been sometimes placed singly, as that of Dunaliskaig, on the Dornoch Firth in Ross-shire; sometimes one large tower is found, encompassed by two or three smaller ones placed about 5 or 6 paces from the large one, and from each other, as Dun Dornadilla, near Tongue in Sutherland; and sometimes several large towers are found situated at a considerable distance from each other in the same district, as in Glen Elg in Inverness-shire.

Glen Elg.

Description.

With regard to the latter, we have been enabled to give the following account of their present state, by the kindness of Mr John Mitchell, the general inspector of the parliamentary roads now carrying on in the north of Scotland, who has been so obliging as to examine and measure them at our request. Glen Elg is the name of a considerable district in the Mainland, lying opposite the south-eastern parts of the isle of Skye, from which it is only divided by a narrow arm of the sea. It consists chiefly of two valleys or glens, that is to say, Glen More or the great glen, and Glen Beg or the little glen. Both of these face towards the isle of Skye. Four of the round towers stand in Glen Beg, and they are all situated on the north-east side of its river. The first stands about a mile and a half from the sea shore, upon the west shoulder of the ridge which separates the two glens: it is considerably elevated above the bottom of the valley, and commands a view of the narrow part of the strait called Kyle Rhea, and also a considerable portion of the southern end of the isle of Skye towards the island and bay of Oronsay. This tower has been totally demolished; a circle of loose stones only distinguishes its site; they are generally large, and naturally well shaped. From this a second tower is seen, at the distance of about half a mile from the former. It stands upon a piece of flat ground close by the side of the river. It is of a circular form, and the external circumference is 178 feet. Of this, 112 feet appears above the surface of the ground, only sufficient to shew the thickness of the wall to be 10 feet; but 66 feet of the north-east quarter is still 26 feet high. This part is 10 feet thick at the foundation, and 4 feet at the top. Near the western extremity of the part which is standing, but on the northern part of the general circle, there is an entrance doorway 6 feet high, and 3 feet 6 inches wide. The bottom of this doorway is a little below the present surface on the outside, but on the same level with the surface within the tower. On entering this doorway, there is an entrance to a passage nearly in the middle of the wall, which is 5 feet 9 inches high, and 2 feet 8 inches wide at the bottom, and from 12 to 20 inches at the top, which is lintelled with flat stones. There is no other opening but the aforesaid doorway in this standing part. The difference between the top and bottom thickness of the wall is all taken off the outside by a concave batter, resembling that of the Eddystone light-house, the inside surface of the wall being nearly perpendicular. Nearly in the middle of the wall, there are four heights of passages over each other. The lower one is ascended from the doorway, by a few steps and an inclined plane to the height of about five feet. The passage, as has already been observed, is about 5 feet 9 inches high, and 2 feet 8 inches wide, and is lintelled with thin flat stones. The upper passages are from 3 to 4 feet high, and 12 to 20 inches wide. Within the tower, immediately over the doorway, there are seven small openings perpendicularly over each other, and only separated from each other by thin flag stones, which also alternately form the divisions between the passages. The lowest of these openings are each about 20 inches square, the uppermost 18 inches square. Near the other extremity of the standing part, there is another range of openings exactly similar to those already mentioned; and half way between them, there are two openings of about the same size, and on a level with the uppermost of the said ranges. On a level with the top of these openings, a course of thin flag stones project from six to eight inches all along the part of the wall which now remains. The external face of the tower is composed of stones naturally well shaped, laid in a very close and regular manner. For about six feet in height, the stones are rather of a larger size than those above them, but all are equally well laid. In the interior surface of the tower they are also well laid, but not quite so perfectly as in the external surface. In the passages the surfaces are more irregular; but in no place is there any appearance of any sort of mortar, or the use of hammer, or other instrument. From this second tower there is seen, at the distance of about 600 yards, a third, standing in the bosom of the hill about 400 yards from the river, and on ground elevated about 30 feet above it. It is of a circular form; the external circumference is 165 feet. Of this, 81 feet of the eastern quarter is 21 feet in height, the wall is 12 feet thick at the bottom, and 6 at the top. The remaining 84 feet of the circumference is about 12 feet high on the lower side, but owing to the steep declivity of the ground, the top of this part rises only to the level of the surface of the ground on the upper side. There is no entrance visible on the outside of what now remains. Nearly in the middle of the wall, there are three stories of passages divided from each other by thin flags; they are each four feet in width, and from 3 to 3 feet 6 inches in height. The bottom of the lowest passage is about 7 feet above the surface of the ground. There is in the part now standing, five openings similar to those described in No. 2. They are each from 2 feet to 18 inches square; the external surface is built with a straight batter; the internal nearly perpendicular; the masonry is composed of stones rather larger than the former, not of so good a quality, but quite as regularly laid. The whole of the interior surface of this tower appears as if it had been injured by the fire. From this third tower, at about a mile and a half still further up the glen, a fourth tower is situated upon a bold point of rock, close to and about 120 feet above the river. This is of an oval shape. Its interior diameter is in one direction 53 feet, in the other 38 feet. In the southern quarter, there is from 6 to 12 feet standing above the general surface of the rock, all the rest is demolished. In some parts, the stones are lying about the foundation, in others, part of the rock has given way; and, with the stones of the building fallen down into the river, the thickness of the part now remaining is 12 feet. On the north-east side, there is a doorway 3 feet in width, and the height is from 5 to 6 feet. At one place in the southern quarter, there is a passage 2 feet wide, and 3 feet high. The external surface of the part now standing is built of well-shaped stones, regularly laid, but not of a large size. From this tower, that which we have named, No. 3. is seen, but none of the others, and it is from No. 1. only that there is a view of the sea. There is also another of these sort of towers upon the shores of Loch Duich, standing upon a rocky eminence immediately above Tuteg ferry; and it is said the remains of others may still be traced in Glen Elg, but we have not received any authentic account of them.

Dun Dornadilla.

In the largest of the towers of Dun Dornadilla, situated near the top of Loch Tongue, in Sutherland, the walls are 30 feet high; the outer circumference is about 150 feet; the diameter of the inner area is 27 feet, which leaves about 10 feet 6 inches for the thickness of the walls, including the passage; in this passage there is a stair from the first to the second story.

Dunalaskaig.

The tower of Dunalaskaig, in the Dornoch Firth, is not situated upon any promontory, but upon the side of a steep bank, opposite to the vitrified fort which occupies the top of the conical hill of Criech. It stands about 50 feet above the level of the sea, and the view from it is rather confined. The present height, on the upper side next the public road, is about 11 feet; but on account of the steepness of the bank, the foundation of the lower side is about 7 or 8 feet under the level of that on the upper side. The form appears to be exactly circular; the diameter of the inner area is 31 feet; and the thickness of the walls, including the passage between them, is about 12 feet. On the inside of the inner wall, at about five feet above the present surface of the ground, there is a ledge or offset all round, of about one foot in breadth, which of course reduces the diameter, at this place, to 29 feet; but from this the face of the wall tapers downward, so that at the surface of the ground the diameter is 31 feet. Below the level of this ledge there is only one opening; this is on the north east side, and is 4 feet 9 inches high, 3 feet 2 inches wide at the bottom, and 2 feet 9 inches at the top. On each side of this opening there is a jamb with a recess, as if to receive a door to be fastened on the inside; there are also holes, apparently for wooden bars, at the back of the door immediately within the jambs. On each hand, there is an opening like the entrance to a passage in the middle of the wall; the one is 1 foot 6 inches, and the other 2 feet wide, and 3 feet 6 inches high. Round the outer wall there is no other opening but this, but in the inner wall there are four openings placed immediately upon the aforesaid ledge, and opposite to each other; one just over the entrance doorway is 4 feet high and 3 feet wide, the others are partly broken down. In the passage between the walls there are steps of a stair; this passage is about 3 feet 3 inches in width at the entrance, but diminishes to about 18 inches near the upper part; the middle is 4 feet 6 inches in width, from the steps or lintelling over the head; the height is from 5 feet 9 inches to 6 feet. There have also been two other staircases between the walls. The masonry is composed of stones similar to those now lying in the immediate neighbourhood. They are large, naturally well-shaped, and laid with great regularity; but neither externally nor internally, is there any appearance of artificial dressing by means of a hammer or other instrument. From the light to the passages in the middle of the walls, having, in all these structures, been procured from the inside area, it would appear that this never was covered at the top; and yet, in those northern countries, it is improbable that people could remain long thus exposed in these open inclosures; it is equally improbable that the narrow staircases and passages could be employed as permanent dwellings. These buildings must therefore have been only signal towers, or very temporary places of refuge; or they may perhaps have been employed for religious purposes; but whatever were their original destination, it is sufficient, in the present enquiry, to know that they were all built in a regular manner without mortar.

Roman works.

Lime mortar.

During the 400 years in which the Romans possessed Britain, the modes of building were completely changed: the introduction of lime mortar was alone sufficient to form a new æra. The fortified ramparts constructed between the Forth and Clyde, and Newcastle and the Solway Firth, were a school with which the northern mountaineers, from their constant efforts to destroy them, were, no doubt, quite familiar. The art of combining into one compact and comparatively impenetrable body, the smallest and most irregular stones, must have immediately struck a people eager to seize any means of obtaining more perfect protection. We accordingly find the vestiges of very old towers constructed in this manner upon insulated rocky promontories, along the whole of the sea coast of Scotland; also on the shores and islands of the numerous inland lochs; and in the passes and commanding stations of the mountains. They are most usually single towers of three stories in height, but not unfrequently, in those reckoned royal residences, the buildings were of greater extent, as Inverlochy castle in Lochaber, which is a regular square, with round towers at the angles: or they consisted of one plain square only, as Balvarie, Elgin, and Duffus, in Moray. In other places, in order to occupy the whole rocky or insulated site, they were of an irregular shape, as at Urquhart upon Lochness, and Dunstaffnage upon Loch Etive; and Ruthven in Badenoch stood upon a neck of high ground projecting into a marshy plain, terminating in a conical mound, on which the castle was built; the area on the top was 100 yards by 30, the south wall 9 feet in thickness, the other side was four feet; there were two turrets at the northernmost angles. This was the seat of Comyn, Lord of Badenoch.

Old castles of various forms.

What relates to the protection of towns, forms a part of military architecture; and in the country, until a very late period, the rude and turbulent chieftains continued to inhabit their castellated towers.

Ecclesiastical edifices

With regard to places of worship, unless the circles of rude stones placed in the ground are considered to have been appropriated to religious purposes, nothing can be traced north of the Tweed prior to the 7th century. About this time Old Melrose, Coldingham, and a church at Tynningham were founded. (See Chalmers's *Caled.* vol. i.) Respecting the first of these, it is said, that within 16 years after Lindisfairn in Northumberland, (viz. 635,) a religious house was established in a peninsula on the south bank of the Tweed at Maol-ross. On the death of Aidan, the celebrated Cuthbert entered the monastery of Melrose as a monk under Roisel. Coldingham was founded during the reign of Edgar, who considered himself much indebted to St Cuthbert for his crown; and it is also said, that in 1098, the priory of Coldingham was founded by the abbot of Durham, who sent monks hither. Notwithstanding this introduction, ecclesiastical architecture made little progress in Scotland till the time of David I.; but during his reign it was carried to an extent apparently beyond the resources of the country. The following edifices are known to have been founded by that prince:

Edifices founded in the time of David I.

The cathedral of Glasgow	in the year	1129
Ditto . . . . . . Dunkeld	. . ditto . .	1130
Ditto . . . . . . St Andrew's	ditto . .	1140
Ditto . . . . . . Aberdeen	. . ditto . .	1154
The abbey of Holyrood-house	ditto . .	1128
Ditto . . . . Kelso	. . . . . ditto . .	1128
Ditto . . . . Melrose	. . . . ditto . .	1136
Ditto . . . . Kinloss	. . . . . ditto . .	1141
Ditto . . . . Jedburgh	. . . ditto . .	1147
Ditto . . . . Dryburgh	. . . ditto . .	1150
Priory of Urquhart in Moray	ditto . .	1125

The chartulary of Elgin not going beyond 1200, we are ignorant when it was erected into a bishopric, but it has most probably been also indebted to David I. In 1178, William the Lyon founded the great abbey of Aberbrothick; and in 1230, Alexander II. the priory of Pluscardine in Moray.

In the best style.

These structures, although inferior in magnitude to many in England, were yet of no inconsiderable size, and they were generally in the best style of Gothic architecture. As each of them will be more particularly described when treating of the places where they were situated, and will also be referred to under the Practice of Architecture, the following dimensions may, for the present, enable the reader to form a tolerably correct idea of their magnitude.

St Andrew's. Glasgow. Elgin.

The cathedral of St Andrew's was 370 feet in length, 62 feet in breadth, and the length of the transept was 322 feet. The cathedral of Glasgow is 339 feet in length within the walls, 72 in breadth, 90 in height from the floor of the choir to the roof, and the tower and spire are in height 228 feet. The cathedral of Elgin is 284 feet in length, 71 in breadth, the transept is 114, and the central tower 198 feet. The abbey of Aberbrothick is 370 feet in length, 62 in breadth, and the transept 165 feet. Under the head of Practice will be found a very minute description of each apartment of the priory of Pluscardine.

Collegiate churches.

Chalmers says, that the collegiate churches were not known in Scotland till the reign of David II. The first was established at Dunbar by Patrick, Earl of March, in 1342; the next was at Dunglass in 1403 by Sir Alexander Home of Home. After this several others were established in Haddingtonshire. In 1446, William St Clair, Earl of Orkney and Lord of Roslin, founded a collegiate church at Roslin, for a provost, six prebendaries, and two choristers, and endowed it with various lands and revenues. It was consecrated to St Matthew the apostle. The chapel is justly admired as a singularly beautiful piece of Gothic architecture; the inside is 69 feet long, and 34 in breadth; the roof is supported by two rows of clustered columns, eight feet high; the middle aisle is one continued arch, enriched by exquisite sculpture. The comparative smallness of the dimensions of this edifice, gives it the appearance of a fine model of a Gothic cathedral.

From this general sketch we shall proceed to a brief detail of the progress of architecture in the two principal cities in Scotland; and we conceive it will be most distinct and satisfactory to state the progress made in each city separately, beginning with the capital.

Architecture in Edinburgh.

This city appears to have taken its name from Edwin, a Saxon prince of Northumberland, who began his reign in 617. For several centuries afterwards, the castle only seems to have been of any importance. It is uncertain at what period it came into the possession of the Scots: It is known that Margaret, the widow of Malcolm Canmore, died in it on the 10th November, 1093. The first distinct information respecting the city, is derived from the charter granted by David I. in 1128, in favour of certain canons regular, for which he founded the abbey of Holyrood-house. From this instrument it appears, that Edinburgh had previously been erected into a royal burgh. In the reign of Alexander II. the first parliament was held in Edinburgh in 1215. In 1255, the daughter of Henry III. of England, the betrothed queen of Alexander III. had the castle appointed for her residence. Robert I. bestowed upon the burgesses of Edinburgh the harbour and mills of Leith. In 1437, the kings of Scotland had their usual residences in Edinburgh; and parliaments were frequently held in it. (See Arnot's *Hist. of Edinburgh.*) By this time the city must have been extensive and well built, for a writer of the 16th century, (Braun Agrippinensus, lib. 3. *voce* Edin.) says, "In this city there are two spacious streets, of which the principal one, leading from the the castle, is paved with square stones. The city itself is not built of bricks, but of square freestones, and so stately in their appearance, that single houses may be compared to palaces. From the abbey to the castle there is one continued street, which, on both sides, contains a range of excellent houses, and the better sort are all built of hewn stone." Few cities in the island could, at this time, justify a similar eulogium.

Holyrood House. Abbey. Fine Gothic. Roslin.

Although we have accounts of many religious houses in Edinburgh which have fallen into decay, yet, as far as regards the architecture, excepting the abbey of Holyrood-house, there is no vestige deserving of much notice. This, as has already been observed, was founded by David I. in 1128, and endowed with extensive privileges and jurisdiction. It suffered much when the English burnt the palace in 1544, but was speedily repaired. At the Restoration, King Charles gave it a complete repair, and ordered that it should be set apart as a chapel royal; a throne was erected for the sovereign, and twelve stalls for Knights of the Thistle; but its splendour was of short duration, for, in consequence of a mass having been celebrated in it, in the time of James VII. the populace sacked the inside. In 1758, the roof was injudiciously covered with heavy stone slate, in consequence of which it fell down in 1768; since that time, no attempts have been made to repair it. This edifice is of the finest style of Gothic architecture; part of the arches are highly pointed; on the south side are flying buttresses; on the other side they are solid, but of an elegant form, and ornamented with canopied niches and pinnacles on the top; the windows of this side are but slightly pointed. This variation of style arose, no doubt, from its having been repaired at sundry times. Dallaway, in his *Anecdotes of the Arts in England*, p. 30. says, "Of Gothic architecture in Scotland, the most beautiful pieces which remain entire, have their date in the prior part of the 15th century. They are the chapel at Roslin, and that in the palace of Holyrood-house, the last mentioned of which was finished about 1440, by King James II. of that realm. Their sides are flanked with flying buttresses,

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like those at King's College and Westminster, but with happier effect; because in a purer style.

Parliament House.

The Parliament House was begun in 1631, and completed about 1640, at the expence of L. 11,600. The style is similar, in many respects, to that of Heriot's Hospital; and therefore, probably a design of Inigo Jones. Its front to the square was plain, but respectable; it had hanging square turrets at the extreme angles, with a round tower at the interior angle of the square. Some of the windows had pointed pediments; others flat cornices, with sculptured ornaments over them. The principal entrance had pilasters, and a flat entablature. There were statues over the pilasters, and a tablet, with a pediment over it, in the middle between the pilasters. The parapet, along the front, was a sort of fret work. The great hall is 122 by 49 feet, with a statue of Lord President Forbes, by Roubilliac. This edifice is now considerably changed, to receive the new courts of justice.

Heriot's Hospital.

Heriot's Hospital is known to be a design of Inigo Jones. It was begun in July 1628; it was interrupted by the national disturbances in 1639; was again proceeded with in 1642, and completed in 1650, at an expence of about L. 30,000. It consists of one square court, encompassed with buildings; it has projecting turrets at the external angles, and a square tower over the entrance, which is carried up to double the height of the rest of the building, and finished with a cupola. Belts or string courses divide the several stories. The windows have pediments over them; some of these are pointed, some circular, and open in the middle. The entrance archway has coupled Doric columns with fully enriched entablature; but this is broken by heavy trusses, having grotesque Gothic ornaments. The mouldings round the arch terminates in a scroll; and there are pinnacles over the coupled columns. Immediately above the archway are twisted Corinthian columns: the whole frontispiece is crowned and surrounded by minute sculptures. The interior of the square, which is about 32 yards by 30, has arcades on two sides, and towers at the four angles, in which are stairs. The windows of three sides have pilasters and regular sculptured ornaments over them. In the upper row, on the north or entrance side, in the middle of the sculpture over the windows, there are small niches, with busts in them;—this produces a fine effect. On the south side is the chapel, with very large Gothic windows; but the entrance door has small coupled Corinthian columns, with a circular pediment over each pair, and both these surmounted by a strange sort of circular open pediment.

Change of styles.

We know of no other instance, in the works of a man of acknowledged talents, where the operation of changing styles is so evident. In the chapel windows, although the general outlines are fine Gothic, the mouldings are Roman. In the entrance archways, although the principal members are Roman, the pinnacles, trusses, and minute sculptures partake of the Gothic. The outlines of the whole design have evidently been modelled on the latter style, of the baronial castellated dwelling. It forms one of the most magnificent features of this singular city, and is a splendid monument of the munificence of one of its citizens, George Heriot, a goldsmith in the reign of James the VI.

Holyroodhouse.

We have no direct evidence at what period the palace of Holyroodhouse was first built. The north-west towers were erected by James V. The palace was burnt by the English, in the minority of Queen Mary, but speedily repaired. It then consisted of five separate courts. Some small alterations were, it is said, made by Inigo Jones, at the time he returned from Denmark with the queen of James I. Great part of this palace was burnt by Cromwell's soldiers. The present edifice was designed by Sir William Bruce, a celebrated architect in the time of Charles II. and executed by Alexander Mylne, a mason, to whom a monument has been erected near the Old Abbey. It consists of one square, three sides of which have three stories, composed of the Doric, Ionic, and Corinthian orders. Round the interior of the square, there is an arcade. The west side, in which is the entrance, is only two stories high. Its external façade is a mixed architecture, having a round castellated tower at each extremity. The entrance is ornamented by a fully enriched Roman Doric, with a whimsical shaped open pediment, over the centre of which there is a cupola, with very small Corinthian columns, having its covering or roof in the shape of an imperial crown. Had the whole of the entrance front correspouded with the towers at the extremities, it would have been expressive of strength and protection; as it is, we can hardly wish them exchanged for features of Roman architecture. The external front eastward has a distinct order to each of its three stories; the entablature being continued along the whole front without a break, has a fine effect; the roof is after the French fashion, very high and concave. Though the inside of the square, by the introduction of three orders, has the parts rendered minutely small, yet the outlines being free of unnecessary projections and recesses, and the two upper rows of windows being large and plain, the whole exhibits a correctness and simplicity not frequently met with.

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Entrance described.

East front.

Inside of the square.

Royal Exchange.

The Royal Exchange, situated on the north side of the High Street, was begun the 19th of June 1754, and cost L. 31,457. It is in the form of a square. The north side is 111 feet in length; in the centre of this side, there are four Corinthian pillars. The south, or side next the street, is composed of an arcade, and is only one story high.

College.

Of a more recent date, the College, which formerly consisted of mean buildings, was begun to be entirely rebuilt from a design by Robert Adam. It is yet far from being completed; but the street front, and the southwestern part of the square, have been roofed. We do not consider the site of the edifice as favourable. The noisy streets by which it is surrounded must be equally obnoxious to the professors and students. The justly celebrated architect has added nothing to his fame by the street front. The projections in the centre and at the extremities destroy simplicity. The large semicircular openings near the base of the extreme breaks, appear to weaken those parts which ought to appear strongest. The large semicircle over the entrance is objectionable, being too glaring a feature. The portico is too small for the front, and it is also unnecessarily broken by projections and recesses. In the interior of the square, the rich Ionic arcade in the angle accords but ill with the meanness of the other part which has been executed.

Courts of justice.

In the new Courts of Justice now building in the Parliament Square, the Ionic screens of columns are raised upon too high a basement; and a number of breaks destroy the unity of the design. Indeed, we much doubt if any arrangement of Greek or Roman architecture could, in this situation, produce an effect equally fine with that of the style which has been superseded.

General remarks.

The buildings we have hitherto noticed are all situated in the old part of the city of Edinburgh; and, beside these, there are several others of no inconsiderable merit, but our limits preclude all attempts at describing them. For farther information we must therefore refer to Mr Arnot's excellent book. But, previous to quitting the ancient part of the city, we cannot help expressing our regret, that any style of architecture later than the castellated dwelling has been admitted within its precincts. The smooth regularity of outline, projecting or open colonnades, corridors, and spacious Venetian windows, invented in a more southern climate, are little in character with the irregular but magnificent features of an ancient British city. We are aware, that, in regard to the appropriation of private property, all direct interference is inadmissible; but, in public buildings, the proper character might have been preserved, and, by the aid of judicious architects, the style of even private buildings might have been preserved sufficiently correct. The local boundary of the ancient city is, however, perfectly distinct, and in one evidently wholly new there is less impropriety in a change of style. Even here we doubt if the Greek or Roman modes be the most appropriate; but these having been generally adopted, we shall, in the present hasty remarks, consider them as subject to those regulations and practices.

New Town.

Register Office.

In the New Town, the first building in point of time or consideration is the Register Office, which contains the public records of the kingdom. It is situated fronting the bridge which connects the new with the old city. It would have appeared to greater advantage if removed farther back, upon the more elevated ground which is immediately behind it. Mr Robert Adam made the design, and it was begun on the 27th June 1774. This building, both externally and internally, reflects great credit on the architect. The original design, as given in the works of Robert and James Adam, has in the centre a magnificent circular saloon, covered and lighted by a dome. This saloon is surrounded by small apartments, and the whole of these inclosed by buildings in the shape of a parallelogram. By this ingenious contrivance, the admission to all the apartments, and affording light to the whole, is perfectly accomplished. Only a part of this masterly plan has been executed, but even this composes an apparently complete building. That the external features have also been the result of much attention, is evident from the chasteness of the details. A greater degree of magnificence, we will venture to say, might have been obtained by keeping the basement of the principal front lower, adding to the magnitude of the order, and continuing a full colonnade for the whole distance between the breaks at the extremities of the building; also continuing a range of pilasters, with full entablature, along each end; having no Venetian windows, nor semicircular arches, in the principal front; making fewer windows, and those nearly double their present size, in the upper range; having no pediment in the centre, nor small cupolas at the extremities; and by rendering most part of the roof visible. The terrace in the front has a good effect; but one direct broad flight of steps up to it, would have been preferable to the present small circular ones.

St Andrew's Church.

The public building next in importance is St Andrew's Church, situated in the north side of George's Street. The body of this church being elliptical, does not harmonise with the square portico with which it is united. The double row of small windows, in the body of the church, we hold to be quite incompatible with the true character of a sacred edifice; and its being without either pilasters, or even a full entablature, increases the meanness of its appearance. The steeple being composed of Roman architecture and a Gothic spire, is much inferior to the simply plain but finely tapering English spire, rising from a lofty, plain, square tower. It is, however, superior to most of the sort in Scotland, and is ornamental to the town. Indeed, any fabric, even of inferior merit, which rises above, and interrupts the uniformity of straight roofs, is here advantageous.

Physicians Hall.

On the south side of George's Street, nearly opposite the last-mentioned edifice, stands the Physicians Hall: the principal features of which compose the most chaste design of any public building in the New Town. The basement is kept sufficiently low. There is a noble straight flight of steps in the front. The portico has a bold projection; and the columns rise up to the entablature which forms the upper member of the building; and this entablature is continued round the ends. The pediments over the windows might have been spared; and attics have always, but more especially in a public building, a mean appearance. The general effect, as a piece of street architecture, is much injured by the rude gable ends of the houses on each side: They ought to have been made in character with it. At present, this fine building appears to have been accidentally pushed back from its proper situation. It was designed by Mr Craig, the architect who made the plan of the New Town.

St Andrew's Square.

To the east, George's Street is terminated by St Andrew's Square; and on the eastern side of this square there stands a fine house built by Sir Lawrence Dundas, from a design by Sir William Chambers. It is placed considerably back from the line of the other buildings; and a house on each side is made to have, in front, the appearance of forming wings to it; but, as they stand in a line with the other houses in that side of the square, the space which intervenes between them and the main, or centre house, being only inclosed by a low rubble wall, the apparent connection is destroyed. The large Ionic columns, upon the front of the wings, are too bold for the feeble Corinthian pilasters of the central building, and these are, besides, raised upon too high a basement. It would lessen the clumsiness of the Ionic columns if they were fluted. They stand very properly upon a plinth; and there are pilasters at the angles of the wings; but the columns are advanced before the line of the pilastres, and an attic story is placed over them.

Charlotte Square.

To the westward, George's Street is terminated by Charlotte Square. Its buildings are more uniformly designed, and more highly ornamented, than those of the other square; but we have to regret a too frequent repetition of unmeaning projections and recesses, also of semicircular and glaring Venetian windows. A church, now building on the western side, is yet too little advanced for us to judge what effect will be produced. We are glad to see provision made for a portico of considerable magnitude, placed within a moderate distance of the surface of the ground.

General Remarks.

The general plan of this new town is regular and convenient, and there is a proper subordination of streets. In this northern climate, and exposed situation, perhaps it would be an improvement if the cross streets on each side of George's Street had not been opposite to each other, and if the length and uniformity of the principal streets had, in some instances been interrupted. We are surprised, that it has never occurred to architects employed in laying out new towns, that monotony ought studiously to be avoided. The New Town of Edinburgh is greatly injured by it. Here the streets are spacious, and the houses excellent; but the uniformity is tiresome, and the repeated sameness of all the divisions resembles a panorama of square battalions. To any person of observation it must be evident, that the High Street in the Old Town has a much finer effect than any in the New Town: Also, that the high street of Oxford and Parliament Street, Westminster, are infinitely superior, in point of general effect, to the new streets about Portman Square, Portland Place, or Russel Square, London.

Glasgow.

Cathedral, 1129, A.D.

The only entire cathedral in Scotland.

The city of Glasgow is situated in one of the finest valleys of Scotland, and where the island is most contracted in its breadth. It stands on the banks of a navigable river, and on the great Roman road which passed through the province of Valentia, and has in its neighbourhood an inexhaustible supply of coal. From these circumstances it very early became a place of importance, and, it would seem, also an episcopal see; for Bingham (b. viii. p. 10.) says, that about the year 448, Bishop Ninian of Glasgow built an episcopal church on the confines of England, at Whithorn in Galloway. But from this time we know very little respecting its progress till the year 1129, when Achaius, preceptor to David I. was appointed to the see. He began to rebuild and adorn the cathedral church, and, although in a very early stage of its progress, consecrated it, in presence of the king, upon the 9th July 1136. At this time it enjoyed the tythes of the lands of Peebles, Selkirk, Roxburgh, Dumfries, and the stewartry of Annandale, bebesides lands in Cumberland. In 1174, Jocelin, abbot of Melrose, was consecrated bishop. He enlarged the cathedral, and dedicated it on the 9th July 1197. Previous to this ceremony, William the Lyon granted a charter, erecting Glasgow into a royal burgh. The completion of this cathedral was accomplished by degrees, at periods remote from each other. In 1240, William de Boddington made reparations and additions. Between 1387 and 1408, when Matthew Glendinning (of a family of that name in Eskdale) was bishop, the steeple, which was of wood, was burned down. Bishop William Lauder laid the foundation of the vestry, and built the great tower as far as the battlements, from 1408 to 1425. Between 1484 and 1508, Bishop Rob. Blackadder founded, and built to its present height, the great south aisle, and also the south cross. In 1560, Bishop Beaton, alarmed by the interference of the reformers, withdrew to France, and carried with him all the valuables of the cathedral. This is now the only entire cathedral church upon the main land of Scotland. All the windows, buttresses, roof, and spire, remain nearly perfect, and promise long to continue the chief ornament of the city.

St Andrew's Church.

Of the other churches, that of St Andrew's, in the middle of a square of that name, is the principal. Both externally and internally, it is nearly an exact copy of St Martin's in the Fields, London, and, of course, partakes of its excellencies and defects. The staring vases along the parapets, detract from simplicity; and the steeple (which differs entirely from the original) is lofty, but so ill designed, that it appears to be narrowest at the base.

Spires resemble pagodas.

There are many other churches in Glasgow, but they are all very inferior to this. They have uniformly two rows of windows; and their spires being a repetition of square boxes placed on each other, having their divisions distinctly marked by cornices, they very much resemble the eastern pagodas. Several are carried up nearly perpendicularly, others taper a little, and are (as that of St Enoch) finished with the point of a spire.

New church, St George's Square.

Church on the south bank of the Clyde.

Hutcheson's Hospital.

There has lately been a church built on the western side of George's Square, in the front of which are a multitude of small breaks. There are pilasters at the extremities, and columns on each side of the entrance door, which seem to have very little connection with each other. Over these columns rise a sort of turrets, which run up part of the steeple. The steeple is itself composed of six or seven different divisions in height. Although there are only one row of windows in the front, there are two in the sides of the church. The architect has, on the whole, deviated widely from our ideas of simplicity and propriety. In a still clumsier style, a church is now constructing on the southern bank of the Clyde. The front, consists of three stories of regular dwelling-house looking windows. The upper ones are small attics. The sides of this church do not correspond with the front; and the tower or steeple is in the pagoda style. This total departure from the character of a church is the more remarkable, as we are informed, that the same architect designed Hutcheson's hospital; and the outlines of its front, which faces Hutcheson's street, appears to us correct and fine. Here the basement is perfectly subordinate to the order, which reaches to the roof, and has its entablature passing unbroken along the front. Within the colonnade there is only one row of windows, which conveys a distinct idea of one apartment only, and there being niches near the extremities, the whole is expressive of a public building. The steeple, though unfortunately still composed of separate divisions, tapers gradually from its pedestal. Several of the minuter ornaments of this edifice might be changed or omitted with advantage.

Theatre.

Buildings by Adam.

In the front of the theatre, by the same architect, the proportion between the basement story, and the fine Ionic order above it, is also well preserved; but the unnecessary projection of the two pair of columns, the arches over the lance doors, and small circles in the attics, detract greatly from simplicity. In this city, there are several public buildings designed by Robert Adam, viz. the infirmary, trades-hall, and assembly-rooms. They are fine buildings, and ornamental to the city; but the profusion of projections, recesses, Venetian windows, and large semicircles, are destructive to chastity of design.

Hunter's Museum.

College.

Courts of Justice.

Hunter's museum, in the college garden, is a correct regular building. The portico, which is Roman Doric, rises from the pavement to the roof, but the cornice only is continued round the other parts of the building. The whole does great credit to the architect Mr Stark. The garden front of the college has been lately new modelled from a design by Mr Peter Nicholson, whose excellent elementary architectural works have, in many instances, tended to connect science with taste. In this front, he has introduced the Greek Doric columns in the central part, and panelled pilasters at the extremities. We regret he has not continued these columns to be regularly connected with the aforesaid pilasters, and thereby have excelled Mr Wyat's new front at Oriel college, in Oxford. The balusters at the windows might have been spared in Greek architecture. The new courts of justice now erecting, from designs by Mr Stark, promise some fine features. The Doric order upon a well proportioned basement, occupies the whole height of the front. There is reason to expect a bold portico; but we regret, that its connection with the extremities is not perfectly made out by pilasters, and that the architect has not contrived to have one row of large windows only in the principal front. The dressing in the Vanburgh manner over some of the windows, do not accord with a chaste Greek Doric, when the projection of the pilasters at the extremities are too delicately small.

General remarks.

The whole of Glasgow as a city, has, in point of architecture, more merit than is generally met with. Standing on comparatively level and smooth ground, it has none of the wild irregularity of old Edinburgh, yet the Tron and Argyll streets partake of the grandeur of the High-street of the capital. The style of the new streets in Glasgow, accords sufficiently with those of the more ancient parts. There being a considerable difference in the fronts of individual dwellings, and these frequently mixed with public buildings, a street architecture is found here much preferable to that of the new town of Edinburgh.

Other towns.

In the towns of Stirling, Linlithgow, and Dunfermline, may be seen the remains of royal palaces. They have been castellated squares, with chapels. That at Linlithgow is upon a magnificent scale, and has still a very striking effect. At Stirling, the palace built by James V. has its northern and western fronts in a very peculiar style, which deserves the attention of the young architect.

Hopetoun house.

Fleurs.

Gordon castle.

Pennycuik.

Duddingstone.

Melville castle.

Culzean house.

Eglinton.

Wemyss.

Roseneath.

Plate CLXXXI.

After the Roman architecture had been revived in Britain, the Scots imitated their southern neighbours in abandoning the castellated dwelling, and adopting the Palladian style. In 1698, the villa of the Earl of Hopetoun was begun upon the south bank of the estuary of the Forth, from a design of Sir William Bruce, the architect of Holyrood-house. The wings were afterwards added by Mr Adam. The beauty of the situation, and the magnificence of the structure, are well known to form a principal feature in a scene which, for extent, richness, and variety, admits of few equals. This taste in architecture was extended over the kingdom, from Fleurs, the seat of the Duke of Roxburgh near Kelso, to the superb dwelling of the Duke of Gordon on the coast of Moray. In 1761, Sir James Clerk, a man of genius and fine taste, built his elegant seat at Pennycuik, in Mid-Lothian. It is a regular square edifice; the basement and order are well proportioned; it has a bold portico of six Corinthian columns; the entablature runs round the whole building; and one row of large windows in the front corresponds with this fine order. In the same county, Duddingstone house is an equally correct design by Sir William Chambers; and Melville Castle has been rendered, by the ingenuity of Mr Adam, a still more magnificent and appropriate feature in this part of Great Britain. The same architect, with his usual fertility of invention, has in Culzean house, on a bold promontory on the coast of Ayrshire, rendered the seat of the Earl of Cassilis a just resemblance of a Roman villa as described by Pliny. Of a still more recent date, are the extensive and finely castellated structures, raised in the same county, by the munificence of the Earl of Eglintoun, and the Countess of Loudon. But perhaps the most extensive and magnificent of all the modern Scottish structures, is Gossford house, built by the Earl of Wemyss, in East Lothian, from a design by Robert Adam; though one little inferior has been erected by the Duke of Argyle at Roseneath, (see Plate CLXXXI.) from designs by the late Mr Bonomi, an ingenious Italian architect, who long practised his art with much success in England.

General remarks.

Having now, we trust, adduced a sufficient number of instances, to convey to the reader a distinct idea of the progress of architecture in Scotland, the nature of this work not admitting of more, we must, therefore, deny ourselves the pleasure of following the ingenious architects of the present day through many works, which reflect great credit upon their taste and skill. We have reason to look forward with confidence to the time, when not only the necessity of having recourse, on important occasions, to the metropolis of the empire for properly qualified artists, will be superseded, but that, emulating the well established fame of her literary characters, Edinburgh will produce a decided superiority of talent in the principles and practice of architecture.

Part II. PRINCIPLES OF ARCHITECTURE.

Not explained by the ancients.

Although, in all civilized nations, architecture has been considered an object of importance amongst men of genius, learning, and scientific skill, yet very few have afforded any satisfactory account of its principles. From Vitruvius to our own times, we have been told of grandeur, order, proportions, harmony, &c.; but it has never been distinctly stated upon what principles these are founded, nor by what means they are to be attained. This very necessary and important art has, therefore, hitherto been too frequently directed by capricious fancy; and the expence and durability of its works, have alone prevented it from experiencing changes equally rapid with those of furniture and dress.

Theories of moderns.

Professor Stewart.

Of late years, men of distinguished talents have bestowed much attention upon subjects connected with this art. To state the various theories which have been advanced, would much exceed our limits. We shall therefore only observe, that the works of Burke, Price, Knight, Reynolds, and Hogarth, afford elaborate and various information; and that the radical errors of those eminent men are fully exposed by Professor Stewart, in his Philosophical Essays upon beauty, sublimity, and taste, more especially the latter, which he proves to be chiefly an acquired faculty.

"The fact seems to be (as Mr Stewart observes) the mind when once it has felt the pleasure, has little inclination to retrace the steps by which it arrived at it. It is owing to this, that taste has been so generally ranked among our original faculties, and so little attention has hitherto been given to the processes by which it has been formed. Dr Gerard and Mr Alison, indeed, have analyzed, with great ingenuity and success, the most important elements which enter into its composition, as it exists in a well-informed and cultivated mind."

Principles correctly made out by Mr Alison.

Fortified by the opinion of this eminent philosopher, we with confidence state an opinion which we have long entertained, that it is from Mr Alison's *Essay on the Principles of Taste* alone, that a satisfactory knowledge of the principles of architecture is to be obtained. We shall therefore endeavour, in a cursory manner, to exhibit his general views of the subject; and, for more perfect information, refer the reader to his elegant and philosophical work.

In treating of the sublimity and beauty of the material world, Mr Alison observes, "It cannot be doubted that many objects of the material world are productive of the emotions of sublimity and beauty: Some of the fine arts are altogether employed about material objects; and by far the greater part of the instances of beauty and sublimity which occur in any man's experience, are found in matter, or some of its qualities; on the other hand, it must be allowed, that matter in itself is unfitted to produce any kind of emotion." And, again, "But although the qualities of matter are in themselves incapable of producing emotion or the exercise of any affec-

Effect of association.

tion; yet, it is obvious, that they produce this effect from their association with other qualities." And, "in works of art, particular forms are signs of dexterity, of convenience, of utility;" and, "in such cases, the constant connections we discover between the sign and thing signified, between the material quality and the quality productive of emotion, renders the one expressive to us of the other, and very often disposes us to attribute to the sign that effect which is produced by the thing signified."

Colours, form, and motion.

That beauty or sublimity is to be ascribed, not to the material, but associated qualities, is shewn by a great variety of illustrations; in regard to the sense of hearing, whether the sounds are simple or composed, and likewise as to the objects of sight, which are colours, form, and motion.

Of Form.

Architecture being so much affected by all that relates to form, it is necessary to attend carefully to what this enlightened philosopher has advanced respecting it. He states, "of all the material qualities, that which is most generally and naturally productive of the emotions of sublimity and beauty, is form; other qualities may be separated from most objects, without destroying their nature; but the form of every material object, in a great measure, constitutes its nature and essence, and cannot be destroyed without destroying the individual subject to which it belongs. From whatever cause, therefore, the beauty of any material object proceeds, it is natural to ascribe it to the form, or to that quality which most intimately belongs to the object, and constitutes its essence to our senses; the common opinion, therefore, undoubtedly is, that forms, in themselves, are beautiful; that there is an original and essential beauty in some particular forms, and that this quality is as immediately discernable as the forms themselves."

Qualities of which it is expressive.

Productions of art.

Having premised thus much, he proceeds to state, that the beauty and sublimity of forms arises altogether from the associations we connect with them, or the qualities of which they are expressive to us, and shews, with great accuracy, the different expressions of which forms are susceptible, and which are the foundation of that sublimity and beauty which are ascribed to them. Of inanimate forms, the principal expressions seem to be, 1st, The expressions of such qualities as arise from the nature of the bodies distinguished by such forms; and, 2dly, The expression of such qualities as arise from their being the subject or production of art. The first constitutes their natural, the second their relative, beauty; besides the expression they acquire from accidental associations, which may be termed accidental beauty.

Natural and relative beauty.

Height, depth, length, and breadth.

Conclusions.

We are next taught, that the natural sublimity of inanimate forms arises from two sources; 1st, From the nature of the objects distinguished by that form; and, 2dly, From the quantity or magnitude of the form itself. Thus forms which distinguish bodies connected with danger, power, durability, splendour or magnificence, awe or solemnity, are in general sublime; magnitude is sublime, as associated with power or strength; with height, it is expressive of elevation and magnanimity; with depth, of danger or terror; with length, of vastness, when apparently unbounded of infinity; and with breadth, it is expressive of stability. But that magnitude is only sublime in consequence of being expressive of those qualities, is shewn by many illustrations. The conclusions which follow, are, 1st, That there is no determined magnitude which is solely or peculiarly sublime, as would necessarily be the case were magnitude itself the cause of this emotion. 2dly, That the same visible magnitude which is sublime in one subject, is frequently the reverse in another; and, 3dly, That magnitude, according to its different appearances, has different characters of sublimity corresponding to the different expressions which such appearances have; whereas, if it were itself sublime, independently of all expressions, it would, in all cases, have the same degree and the same character of sublimity.

Of outlines.

Angular durability.

Curvilinear delicacy.

Respecting the natural beauty of forms, it is stated, that matter is circumscribed, 1st, By either angular lines; or, 2dly, By curved or winding lines. When composed by one of those lines solely, they may be termed simple forms; when they are composed by an union of these lines, they may be termed complex forms. That simple forms may be described by angular or winding lines; and as so, are connected with very different associations, or are expressive of very different qualities. That the greatest part of those bodies in nature which possess hardness, durability, and strength, are distinguished by angular forms; those, on the contrary, which possess weakness, fragility, or delicacy, are distinguished by winding or curvilinear forms; and that this is evident in the mineral, vegetable, and animal kingdom; also, that those which grow and decay, are distinguished by winding forms, but maturer age by forms direct and angular. Likewise, that the sense of touch discovering angular forms to be expressive of roughness, sharpness, winding forms of softness, smoothness, delicacy, very early leave permanent impressions, and afford numerous associations, which form analogies with certain qualities of the mind, and produce some degree of the same emotion. The epithets bold, harsh, delicate, gentle, are universally applied to forms. It is concluded, that the emotions are founded upon the associated qualities, and are very different from the more agreeable or disagreeable sensations which material qualities alone convey.

Besides simple curves, there are serpentine forms, in which different curves take place, or in which a continued line winds into several curvatures, which furnishes an association of ease. When vegetables, or any other delicate body, assume their form, we are impressed with the conviction of its being easy, agreeable to their nature, and free from force or constraint. On the contrary, when such bodies, in the course of their progress, assume angular forms, we have a strong impression of the operation of force.

Nature and direction of lines.

On the subject of lines, Mr Alison makes the following important observations, which deserve the particular attention of the architect. "Lines differ either in regard to their nature or direction. 1. Lines differ in regard to their nature, according to the different degrees of their consistence and strength. Strong and vigorous lines are expressive to us of strength and stability, when perpendicular; and of some degree of harshness and roughness, when horizontal, or in an oblique direction. Fine and faint lines are expressive to us of smoothness, fineness, and delicacy. In any given number of straight lines, that is always the most beautiful which is the finest; or which, while it preserves its continuity, has the appearance of the smallest quantity of matter employed in the formation of it." But these forms are beautiful only in consequence of the associations we connect with them. Destroy that association, and they are no longer beautiful.

only beautiful from association.

Simple forms.

Ornament from the vegetable kingdom.

Delicacy.

In the course of illustrating these subjects, it is stated, that the greater part of beautiful forms in nature are formed in the vegetable kingdom; and accordingly, it is from those of the most delicate texture, that artists have selected forms to imitate, for the purpose of ornaments and elegance; but it is only those which are particularly fine and delicate which are fit for these purposes. On the contrary, the different bodies which constitute the mineral kingdom being distinguished by a greater degree of hardness and solidity, although they may be moulded into any form, yet the beauty of the serpentine form will be lost from the want of the association of delicacy; and we shall feel a discontent, from the seeming impropriety of giving such durable substances a character which does not belong to them. But there are cases, when an adventitious delicacy is given to such substances, by which the character is retained, by the form by which we have associated with them from real nature.

from dexterity of workmanship.

This effect is produced, "1st, when the quantity of matter is so small, as to overcome our opinion of its strength or durability; and, 2dly, when the workmanship is so excellent, as to produce an opinion of fineness or delicacy, independent of the nature of the subject upon which it is employed."

In architecture.

In architecture, it is observed, the great constituent parts require direct and angular lines, in order to convey the expression of stability and strength; and that no ornament can, with any propriety, be introduced, excepting in the minute and delicate parts of the work; and even, in such situations, if those ornaments exceed in size or relief that proportion in point of delicacy we expect them to hold with respect to the whole of the building, the imitation of the most beautiful vegetable forms does not preserve them from censure of clumsiness and deformity.

In further illustrating this subject, it is strongly urged, that, besides the curvilinear form, all those which are expressive of delicacy are also beautiful.

Glass lustre prism.

Such as the glass lustre, which is all angular, the form of the prism, the sword hilt, watch chain, and the forms of various jewels; which, in those hard substances, arises from their being the forms in which there is the smallest possible quantities of matter, being capable of receiving the finest polish, and producing the greatest brilliancy. But one of the most striking instances of the beauty of angular forms, is afforded in the antient tripods, in which there is the utmost possible diminution of solidity, that is consistent with convenience or use; and by its shape converging, and its dimensions lessening as they descend to the ground, there is scarcely a possibility of contriving a more angular form, or one where the slightness and apparent instability of the whole fabric can be more expressive of delicacy; and accordingly, from the principles of this delicate model, the greater part of the most beautiful articles of modern furniture are imitated.

Diminution of solidity.

Conclusions.

From the whole of this investigation respecting the beauty of natural forms, the following conclusions are drawn:—1. "That the beauty of such forms arises from the qualities of fineness, delicacy, or ease of which they are expressive.

2. That in every subject (whether angular or curvilinear) that which is the most expressive of these qualities, is the most beautiful form. And,

3. That in general, the curvilinear, or winding form, as most frequently expressive of these qualities, is the most beautiful. With regard also to those arts which are employed in the imitation or invention of ornamental forms, the following observations may not be without their use.

Delicacy and ease.

1. That wherever natural forms are imitated, those will be the most beautiful, which are most expressive of delicacy and ease.

Pleasing expression.

2. That wherever new or arbitrary forms are invented, that form will be most beautiful, which is composed of the most beautiful lines; or in other words, by lines which have the most pleasing expression. And,

Delicacy of execution.

3. That wherever the subject of the form is of a hard or durable nature, that form will be most beautiful in which the smallest quantity of matter is employed, and the greatest delicacy of execution exerted."

What has just been stated, relates to simple forms only, or to such as are described by a simple line. But as in the greater part of the beautiful forms of nature or art, lines of different descriptions unite, it is necessary to consider the composition of forms; and in doing this, it is observed, that simple forms are distinguished to the eye by the uniformity or similarity of the line by which they are described. Complex forms, by the mixture of similarity and dissimilarity in those lines, or in other words, by their uniformity and variety.

Composition of form.

Great pains are bestowed to make out distinctly, that the mere composition of uniformity and variety, or similarity and dissimilarity of form, is not in itself beautiful, but only where the objects have some general determinate character or expression, and where there is a relation among the different parts of this general character; that different proportions of uniformity and variety are required in forms of different character; that all powerful emotions, and all emotions bordering upon pain, demand uniformity and sameness; and all weak emotions, and all emotions which belong to positive pleasure, demand variety or novelty.

Painful emotions require uniformity; and those of positive pleasure, novelty.

Rules.

From the whole of the discussions, the following excellent rules are laid down.

1. "That whenever beautiful form is intended, some character or expressive form should be selected, as the ground or subject of the composition.

2. That the variety, (whether in the form, the number, or the proportion of the parts,) should be adapted to the peculiar nature of this expression, or of that emotion, which this expression is fitted to excite.

3. Forms of this kind are either simple or dependent.

In simple or independent forms, their character is at the pleasure of the artist; and that will always be the most beautiful, in which the character is best preserved.

4. In dependent forms, on the contrary, or those which are designed for particular scenes or situations, their character must be determined by that of the scene or situation; and that also will be the most beautiful form, in the composition of which the alliance to the general character is most precise and delicate."

Having discussed what relates to simple and composed forms, or what constitutes their natural beauty, the next object of consideration is the qualities which constitute their relative beauty. From the discovery of fitness or utility, we infer the existence of design. In forms distinguished by such qualities, the discovery of an end suggests intention or design; and the qualities of form, which signify this fitness or usefulness, are signs of the design or thought which produce them. But expression of design may be perceived in an object in which neither fitness or utility are to be discovered: this is evidence, "that there are certain qualities of form which are immediately and permanently expressive to us of those qualities of mind, and which derive their beauty from their expression."

Expression of design.

The natural quality most powerfully expressive of design, is uniformity or regularity. In every form where this quality is observed, we infer design; and from the absence of it, we consider the production the work of chance.

Vegetable forms, which approach to the resemblance of animals; minerals, which have a resemblance to vegetables or animals, are reckoned curious, but are never considered as possessing that beauty which excites the emotion of delight. Uniformity or regularity in rocks and mountains, is considered as a defect, and beheld only with surprise. Uniformity and regularity, therefore, are only beautiful when associated with intention or design.

Variety of embellished design.

Uniformity being expressive of design, and variety of embellished design, the beauty of forms will be most perfect when these two are duly proportioned; that is, "when the unity of design is equal, the beauty of forms will be in proportion to their embellishment; and when the embellishment is equal, their beauty will be in proportion to the unity of design."

Expressive of skill of the artist.

Character of the subject.

The qualities of uniformity and variety are beautiful from the expression of design. They are also beautiful from the effect of their composition, in maintaining and promoting the emotion which the subject itself is capable of exciting. Their composition is, in some cases, beautiful, from being expressive of the skill of the artist, and of others from being correspondent to the character or expression of the subject. The confounding of these distinct expressions, has been the cause of the greater part of the mistakes which have been made in the investigation of the beauty of these qualities.

It is of the greatest importance that the artist should pay attention to this part of the subject, because it is in his power either to sacrifice the beauty of design to that of character or expression, or the beauty of character to that of design. He ought to be fully aware of the superiority of the beauty of character or expression, in producing the greater and more affecting emotions over that of design. Also of its being more universally felt, being only dependent on our sensibility, while that of design can only be fully felt by those who are so far proficients as to judge of skill, &c.; and likewise, that the beauty of character or expression, by depending upon invariable principles of our nature, is much more permanent than that of design, which is influenced by every period of the art. It may therefore be considered a first or fundamental principle, "That the expression of design should be subject to the expression of character; and that in every form, the proportion of uniformity and variety which the artist should study, ought to be, that which is accommodated to the nature of this character, and not to the expression of his own dexterity and skill."

Expression of design subject to that of character.

Fitness constitutes relative beauty.

Fitness, or the proper adaptation of means to an end, is another source of the relative beauty of forms. In every profession, all machines, instruments, and even the most common utensils, which are well adapted to their several purposes, are, by artists, denominated beautiful. A physician talks of a beautiful theory of fevers, a surgeon of a beautiful instrument for operation, an anatomist of a beautiful subject or preparation; these instances shew, that even the objects which are most destitute of natural beauty, become beautiful when they are regarded only in the light of their fitness. Pleasing or agreeable forms receive additional beauty from being wisely adapted to some end.

"The beauty of proportion affects us with the emotion of beauty, not from any original capacity in such qualities to excite this emotion, but from their being expressive to us of the fitness of the parts to the end designed."

What we feel from observing an object which is well proportioned, is not the mere sensation of pleasure from an arrangement of parts, but an agreeable emotion from the perception of the proper disposition of these parts for an end designed.

In most familiar cases, this quality of fitness is so immediately expressed to us by the material form, that we are sensible of little difference between such judgments and the mere determination of sense; but where the object is not so familiar, or the construction is intricate, we do not discover the proportions until we have discovered the principle of the machine, or the means by which the end is attained. But if proportions consisted in any determined relation, discoverable only by a peculiar sense, the consideration of fitness could no more influence our opinions than any other consideration.

Fitness and proportion.

"Every form which is susceptible of proportion, may be considered in either one or other of the following lights. 1st, In the light of its whole or general relation to the end designed, or when it is considered as a whole, without any distinction of parts; or 2dly, In the light of the relation of its several parts to this end. Thus in the case of a machine, we may sometimes consider it in the light of its general utility for the end it is destined to serve, and sometimes in the light of the propriety of the different parts for the attainment of the end. When we consider it in the first light, it is its fitness which we properly consider; when we consider it in the second light, it is its proportion we consider. Fitness may therefore be supposed to express the general relation of propriety between means and an end; and proportion, a peculiar or subordinate relation of this kind, viz. the proper relation of parts to an end. Both agree in expressing the relation of propriety between means and their ends. Fitness expresses the proper relation of the whole of the means to the end; proportion, the proper relation of a part or parts to their ends."

Forms are susceptible of as many determinate proportions, as they are susceptible of parts necessary for the end for which they are intended. If they have any more parts, these are not susceptible of any accurate proportions, and are accordingly constantly varying; and we are only sensible of the proportion of forms, as we become acquainted with the fitness of its construction. Of a new machine, with which we are unacquainted, we cannot decide of the propriety or impropriety of its proportions. The more extensive our knowledge is of the fitness of the forms for their several ends, the better we shall be qualified to judge of the propriety of their several proportions; "and in general it may be observed, that the certainty of proportion is, in all cases, dependent upon the certainty of fitness. 1st, When this fitness is absolutely determined, as in many cases of mechanics, the proportion is equally determined. 2d, Where it is determined only by experience, the opinion of the beauty of proportion varies with the progress of such experience. 3d, Where this fitness cannot be subjected to experience, as in the case of natural forms, the common proportion is generally conceived to be fittest, and is therefore considered as the most beautiful." In following the author through the foregoing discussions, we have merely endeavoured to preserve the connection of his general principles, neglecting most of his beautiful illustrations, and avoiding, as much as possible, the numerous application of his principles to the theory and practice of the other fine arts, our object being only to trace what was necessary to determine the principles of architecture. We presume the reader, who has with attention accompanied us this far, will already have discovered more rational grounds for general principles, than has been furnished by any other author. We are now to proceed to consider the merits of his application of the foregoing principles more immediately to the art of architecture.

General reflections.

Principles applied to architecture.

After remarking, that former writers have been unanimous in considering proportions as deriving their effects from the original constitution of our nature,—and that they have endeavoured to support this opinion by analogies drawn from proportions in music and numbers,—and remarking, that all reasonings from such analogies are too futile to require any attention,—Mr Alison proceeds to show, that the beauty of the proportions of this art is resolvable into the principles which have been established, and that they please us not from any original law of our nature, but as expressive of fitness. The proportions of architecture relate either to its external or internal members. The beauty of external proportions, we are informed, arises from their apparent fitness for the habitations of men when viewed from without, and consists in stability and sufficiency for the support of the roof; walls in every country, in the same period of time, are nearly of an equal thickness for their stability, and to the support of any weight laid upon them; and when their distance from each other is suitable, the building is considered as well proportioned; but when the walls are so thin or high, or placed at so great a distance from each other, as to appear insecure of themselves, or insufficient to support the roof, that building is reckoned to be ill proportioned. Proportion therefore, in those cases, is merely fitness, and this has never been very precisely determined; we are here guided entirely by experience, and our sentiments respecting proportions are influenced by the nature of the buildings, and the materials of which they are composed. Edifices constructed with wood or brick, admit not of the walls being equally high as if built of stone. A house united with others, may be carried higher than if placed alone. A tower or spire having only itself to support, may with propriety be carried to a much greater height than any other species of building. These principles are all that seem to regulate the external proportions of simple buildings, and all of them obviously depend upon fitness.

Proportions please from an expression of fitness.

Principles applied to the orders of architecture.

Having discussed what relates to the proportion or fitness of the general outlines of buildings, Mr Alison proceeds to treat of the orders of architecture, and to show, that their proportions, instead of being intrinsically beautiful of themselves, are regulated by the general principles which have been established in this essay, and derive their merit solely from the expressions of fitness for their several purposes. But as this important part of the discussion overthrows established opinions, which have a peculiarly strong possession of the minds of all those who have paid attention to or are engaged in architectural pursuits, we shall quote the precise words of the author:

"It is not in such (simple) buildings, accordingly, that any very accurate external proportions have ever been settled. This is peculiar to what are called the orders of architecture, in which the whole genius of the art has been displayed, and in which the proportions are settled with a certainty, so absolute, as to forbid almost the attempt at innovation.

"There are generally said to be five orders of architecture, viz. the Tuscan, the Doric, the Ionic, the Corinthian, and the Composite. These are, however, properly only four, and some writers have farther reduced them to three. What constitutes an order, is its proportions, not its ornaments. The Composite having the same proportions as the Corinthian, though very different in respect to its ornaments, is properly, therefore, considered a corrupted Corinthian.

Composition of order.

"Every order consists of three great parts, or divisions; the base, the column, and the entablature; and the governing proportions relate to this division. The whole of them compose the wall, or what answers to the wall of a common building, and supports the roof.

Difference between order and wall.

"There is one great difference, however, to be observed between a common wall, and that assemblage of parts which constitute an order. A common wall is intended to support a roof, and derives its proportions, in a great measure, from this destination. To an order, the consideration of a roof is unnecessary; it is generally so contrived as not to appear: the weight which is supported, or appears to be supported, in an order, is the entablature. The fitness of a wall consists in appearing adequate to the support of the roof. The fitness of an order, or of the proportions of an order, it should seem also from analogy reasonable to conclude, consists in their appearing adequate to the support of the entablature, or the weight which is imposed on them.

Beauty arises from fitness.

"That this is really the case, and that it is from their being expressive to us of this fitness, that the proportions of these different orders appear beautiful, may perhaps seem probable from the following observations:

"1. The appearance of these proportions themselves seems very naturally to lead us to this conclusion. In all the orders, the fitness of the parts to the support of the peculiar weight, or appearance of weight of entablature, is apparent to every person, and constitutes an undoubted part of the pleasure we receive from them. In the Tuscan, where the entablature is heavier than in the rest, the column and base are proportionably stronger. In the Corinthian, where the entablature is lightest, the column and base are proportionably slighter. In the Doric and Ionic, which are between these extremes, the forms of the column and base are, in the same manner, proportioned to the reciprocal weights of their entablatures; being neither so strong as the one, nor so slight as the other. If the beauty of such proportions is altogether independent of fitness, and derived from the immediate constitution of our nature, it is difficult to account for this coincidence; and as the beauty of fitness, in these several cases, is universally allowed, it is altogether unphilosophical to substitute other causes of the same effect, until the insufficiency of this is clearly pointed out.

Illustration.

2. "The language of mankind upon this subject, seems to confirm the same opinion. Whenever we either speak or think of the proportions of these different orders, the circumstances of weight and support enter both into our consideration and our expression. The term proportion, in its general acceptation, implies them; and if this term is not used, the same idea, and the same pleasure, may be communicated by terms expressive of the fitness for support of weight. Heaviness and slightness, or insufficiency, are the terms most generally used to express a deviation on either side from the proper relation; both of them obviously including the consideration of support, and expressing the want of proportion. When it is said, that a base, or column, or entablature, is disproportioned, it is the same thing as saying, that this part is unfitted to the rest, and inadequate to the proper end of the building. When it is said, on the other hand, that all the several parts are properly adjusted to their end, that the base appears just sufficient for the support of the column, and both for that of the entablature, every person immediately concludes, that the parts are perfectly proportioned; and I apprehend, it is very possible to give a man a very perfect conception of the beauty of these proportions, and to make him feel it in the strongest manner, without ever mentioning to him the name of proportion, merely by explaining them to

Heaviness.
Slightness.

Unfitness.

him under the consideration of fitness; and by showing him, from example, that these forms are the most proper which can be devised for the end to which they are destined. If our perception of the beauty of proportion, in such cases, were altogether independent of any such considerations, I think that these circumstances in language could not possibly take place, and that it would be as possible to explain the nature and beauty of proportions by terms expressive of sound or colour, as by terms expressive of fitness or propriety.

Ideas of proportion acquired.

3. "The natural sentiments of mankind on this subject, seem to have a different progress from what they could naturally have, if there were any absolute beauty in such proportions discoverable by the eye. It cannot surely be imagined, that an infant will perceive, or does perceive, the beauty of such proportions, in the same manner as he perceives the object of any other external sense. It is not found either, that the generality of mankind, even when come to mature age, express any sense of the absolute beauty of such objects. It is true indeed, that, very early in life, we are sensible of disproportion in building; because the ideas of bulk and support are so early and so necessarily acquired; and the eye is so soon habituated to judge of weight from visible figure, that what is fit for the support of weight is very soon generally ascertained. What a common person, therefore, expresses upon the view of such proportions, is rather satisfaction than delight. It is not the proportions which most affect him; it is the magnificence, the grandeur, and costliness, which such buildings usually display; and though he is much pleased with such expressions, he is generally silent with regard to the beauty of those proportions with which the connoisseurs are so much enraptured. If proportion, on the contrary, were something absolutely beautiful, in such objects the progress of taste would be reversed; the admiration of the infant would be given to those proportions, long before he was able to judge of their fitness; and the satisfaction which arises from the expression of fitness would be the last ingredient in his pleasure, instead of being, as it now is, the first.

Dependent upon fitness.

4. "The nature of these proportions themselves, seems very strongly to indicate their dependence upon the expression of fitness. The beauty of such forms (on the supposition of their absolute and independent beauty,) must consist either in their beauty, considered as individual objects, or in their relation to each other. If the effect arises from the nature of the individual forms, then it must obviously follow, that such forms or proportions must be beautiful in all cases. I think, however, there is no reason to believe this to be the case; the base of a column, for instance, (taken by itself, and independent of its ornaments, which in this enquiry are entirely excluded from consideration,) is not a more beautiful form than many others that may be given to the same quality of matter. The peculiar form which its proportions give to it, is very far from being beautiful in every other case, as would necessarily happen, if it were beautiful in itself, and independent of every expression. A plain stone, of the same magnitude, may surely be carved into very different forms, from those which constitute the bases of many of the orders, and may still be beautiful. In the same manner, the column (considered as in the former case, merely in relation to its peculiar form, and independent of its ornaments,) is not more beautiful, as a form, and perhaps not so beautiful, as many other forms of a similar kind. The trunk of many trees, the mast of a ship, the long slender Gothic column, and many other similar objects, are to the full as beautiful, when considered merely as forms, without any relation to end, as any of the columns in Greek architecture. If, on the contrary, these forms were beautiful in themselves, and as individual objects, no other similar forms could be equally beautiful, but such as had the same proportions. The same observations will apply equally to the form of the entablature. It would appear, therefore, that it is not from any absolute beauty in these forms, considered individually, that our opinion of their beauty in composition arises. If it is said, on the other hand, that the beauty of proportion in such cases, arises in relation of these parts, and that there is something in the relations of these forms and magnitude, in itself beautiful, independent of any consideration of fitness, there seem to be equal difficulties. Besides the relation of fitness for the support of the weights, the only relations which take place among these parts, are the relations of length and breadth, and the relation of magnitude. If this beauty arises from the relation of length, it is necessary to shew, that such a proportion of these parts, in point of length, is solely and permanently beautiful. If from the relation of breadth, there is the same necessity of showing, that such a proportion of these is point of breadth is permanently beautiful. If from both together, then the same proportion only ought to be felt as beautiful, in all cases to which the relations of length and breadth can apply. If again, this beauty arise from the relation of magnitude, it is necessary, in the same manner, to shew that their magnitudes or quantities of matter, have in fact no other beautiful proportions, but those which takes place in such order; but as it is very obvious, that there is no foundation for supposing there is any such law in our nature, and that, on the contrary, in innumerable cases of all such relations, different and contrary proportions are beautiful; it cannot be supposed that such proportions are absolutely beautiful from any of these relations. The only relation, therefore, that remains, is the relation of fitness, and if the same inquiry is carried on, I believe it will soon be found, that a certain proportion of parts is necessarily demanded by this relation, and very probably also, that this certain proportion, is in fact, in each of these orders, according to the particular weight or bulk given.

Experience discovers fitness.

"If an order is considered as an assemblage of weight, and parts to support that weight, our experience immediately leads us to conceive a proper relation of those parts to their end. If the entablature be considered as the weight, then of course a certain form and size in the column is demanded for the support of it, and in the base for the support of both. A plain stone, for instance, set on its end, has no proportion, further than for the purpose of stability. If it appears firm, it has all the proportions we desire or demand; and its form may be varied in a thousand ways, without interfering with our sense of its proportions. Place a column, or any other weight, upon this stone, immediately another proportion is demanded, viz. its proportion to the support of this weight. The form supported has, however, no proportion further than is necessary for its stability. It may be more or less beautiful in point of form from other considerations, but not on account of its proportions. Above this again place an additional body, 'immediately the intermediate form demands a new proportion, viz. to the weight it supports;' and the first, or base, demands also another proportion, in consideration of the additional weight which is thus imposed upon it. In this supposition, it is obvious, that the consideration of fitness alone leads us to expect a certain proportion among each of these parts. The parts are beautiful or pleasing just as they answer to this demand; and where the parts are few, and experiments easy, it seems not difficult at last to arrive at that perfect proportion which satisfies the eye as sufficient for the purposes of support and stability. If we leave, therefore, every thing else out of consideration, the consideration of fitness alone seems sufficient to account both for the origin of such proportions in architecture, and for the pleasure which attends the observation of them."

But granting that the doctrine of the original beauty of proportion be abandoned as inconsistent with experience, and that of the influence of the expression of fitness adopted, yet it may still be doubted if this is sufficient to account for the delight felt from the orders of architecture, or the uniform adherence to the established proportions.

Mere fitness insufficient.

"It is acknowledged, that the mere consideration of fitness is insufficient to account for the pleasure derived from the established orders. But it is observed, that this pleasure arises from very different causes than from their proportions; and that, in fact, when these proportions only are considered, the pleasure which is generally felt is not greater than that which we experience, when we perceive in any great work the proper relation of means to an end.

"The proportions of these orders, it is to be remembered, are distinct subjects of beauty, from the ornaments with which they are embellished, from the magnificence with which they are executed, from the purposes of elegance they are intended to serve, or the scenes of grandeur they are destined to adorn. It is in such scenes, however, and with such additions, that we are accustomed to observe them; and while we feel the effects of all these accidental associations, we are seldom willing to examine what are the causes of the complex emotion we feel, and readily attribute to the nature of architecture itself the whole pleasure which we enjoy. But besides these, there are other associations we have with these forms, that still more powerfully serve to command our admiration, for they are the *Grecian* orders; they derive their origin from those times, and were the ornament of those countries which are most hallowed in our imaginations; and it is difficult for us to see them, even in our modern copies, without feeling them to operate upon our minds as relics of those polished nations where they first arose, and of that greater people by whom they were borrowed. While this species of architecture is attended with so many and so pleasing associations, it is difficult for even a man of reflection to distinguish between the different sources of this emotion; or in the moments when this delight is felt, to ascertain what is the exact proportion of his pleasure, which is to be attributed to these proportions alone; and two different causes combine to lead us to attribute to the style of architecture itself, the beauty which arises from many other associations."

Accidental associations.

Material sign of affecting qualities.

In the first place, while this architecture is under our eye, it is the central object of all those associations, it is the material sign of all the affecting qualities, and disposes us to attribute to the sign the effects which are produced by the qualities signified. And even these very proportions are the cause of our pleasure, because they are the only qualities of the object which are accurately ascertained; they have long been the acknowledged objects of beauty, and having got possession of one undoubted principle, we are easily induced to ascribe the whole effect to this principle alone.

Common people. Men of letters. Artists. Dimensions.

That this is really the case, will appear evident, by considering that the common people feel a very inferior emotion of beauty from such objects, to that which is felt by men of liberal education; the man of letters feels also a weaker emotion than a well-educated architect, because he has none of the associations which belong to the art, and never considers them in relation to the skill or invention they display. Deprive these orders of the customary ornaments, or change only, in the slightest degree, their forms, without altering their proportions, and their beauty will be in a great measure destroyed; or preserve the ornaments, forms, and proportions, but diminish them to a small scale, and their effect will be much inferior to what they produce, when executed on the magnificent scale of the antient temples; or destroy the associations of elegance, magnificence, costliness, but, above all, of antiquity; and it must appear evident, that the pleasure which these proportions would afford, would not be greater than that which we feel in other cases, when means are properly adapted to their end.

Antiquity. Costliness.

In regard to the observation, that the universal adherence of mankind to these proportions is a sufficient proof of their absolute beauty, it is necessary to remark, that the associations of antiquity alone, have a powerful effect in producing uniformity of opinion; also, that in the productions of human labour, the influence of variety is limited by the costliness and durability of the materials upon which that labour is employed; where they are very costly, the objects have great intrinsic value, independent of any particular form; and the same form is therefore adhered to with little variation. Even in dress, it is in the parts the least costly that the most frequent changes take place. Architecture is of all the fine arts the most costly; the revenue of nations is scarcely sufficient to defray the expence of frequent productions of its most magnificent forms; and the art itself, after it has arrived at a certain necessary degree of perfection, remains in a great measure stationary, both from the infrequency of cases in which invention can be employed, and from the little demand there is for the exercise of this invention.

Durations.

The objects upon which this art is employed, besides being costly, are also very durable. Centuries must probably pass before they are renewed, and during that time, the sacredness of antiquity is acquired by the subject itself, and likewise a strong motive for the preservation of similar forms.

The foregoing observations relate wholly to the external parts of architecture. It is therefore necessary to consider, whether the Internal Proportions are guided by the same principles.

Internal proportions.

Internal proportions arise from the disposition of length, breadth, and height, so as to render an apartment pleasing in its forms; and certain proportions of these dimensions have been held as beautiful in themselves, from the original constitution of our nature, and independent of any expression; but, agreeably to the principles established in this Essay, the beauty of their proportion arises from the expression of fitness.

A plain wall is only capable of that proportion of height which is necessary for the expression of strength and stability. This is all we desire; it is also, of course, Walls to support the roof.

applicable to four walls inclosing a space. But add a roof to this inclosure, and other proportions are demanded, in consideration of the apparent weight which is to be supported. If the walls are too high, they seem insufficient for the weight; if too low, the roof appears unnecessarily heavy; and if the length is too great, the weight of the roof, by the perspective, appears to become too great as it retires; if the breadth is too great, there is an apparent insufficiency created by the too great distance of the walls: Certain proportions, therefore, in length, breadth, and height, fitted for the full and easy support of the roof, are required. If these are accomplished, we require no more; and if they are not accomplished, every person is sensible of the defect. It therefore follows, that these proportions are beautiful, from being expressive of fitness. The real beauty of the internal proportions of architecture is not, to the bulk of mankind, greater than what attends the expressions of fitness; it is satisfaction rather than positive delight. In apartments where this proportion has been studied, it is with the convenience, furniture, decorations, or magnificence, we are delighted. With the mere outlines of the best proportioned, but unfinished, room, we have only the same moderate pleasure which we receive from observing a well-constructed machine. "If, therefore, certain proportions are demanded in a room as expressive of fitness, and if the emotion that is produced by the established and regular proportions is no greater than that which we receive in other cases; from the expression of this quality, it seems reasonable to think, that these proportions are in fact beautiful, from the expressions of this fitness." The common language of men confirms these statements: they express their sense of proportions by too high or too low, by being heavy or light; and in explaining to them the nature of internal proportions, we should do it by pointing out, that the walls were well fitted or adapted to support the weight; or that they were too high, or too low, or too distant, or that the roof was heavy or light; but this might, and most probably would, all be done, without even mentioning proportions, but referring to the expressions of fitness.

The progress of taste is also decisive upon this subject. If proportions were originally beautiful, the early period of life would be remarkable for the discovery of them; but every one is sensible, that it is only after we have, from experience, acquired a knowledge of the relation between weight and support, that we are sensible of proportions. If there were any absolute and independent beauty in forms, every violation of them would be equally painful; but it is evident that this is not the case: too great a height or length in any apartment, is not so disagreeable as too great a breadth, or being too low. No uniform emotion, therefore, attending the perception of these proportions, as would necessarily be the case if their beauty were perceived by any peculiar sense, and the emotions which we receive from them being different according to their different expressions of fitness, it seems reasonable to ascribe their beauty to this expression, and not to any original beauty in the proportions themselves. If there were any original beauty in such proportions, they would be as certain as those of any other sense; there would be one precise proportion of these dimensions, of length, breadth, and height, solely and permanently beautiful. But no artist has pretended to determine any such proportions; on the contrary, there is no permanent beauty in any one relation of those dimensions; the same proportions which are beautiful in one apartment, are not so in another.

Causes of difference of opinion.

There appear to be three causes for the difference of our opinions of proportions: 1st, From the consideration of the weight supported. As roofs are usually composed of timber, and supported by walls, the necessary dimensions are not very precisely determined; and they may, accordingly, be varied within certain limits. These limits are less rigorous in the case of length or height, than in what regards breadth; for the same proportion of breadth which is beautiful in one case, would be positively disagreeable in another.

Character of apartment.

Require different proportions.

2d, The difference of opinion arises also from the character of the apartment, as gaiety, simplicity, solemnity, grandeur, magnificence; for no room is beautiful which has not some expressive character. The same proportion which is beautiful in a room of gaiety, would be a defect in one whose character was that of simplicity; the same proportions which are pleasing in an elegant or convenient room, would be defective in an apartment of magnificence and splendour. In general, the great and positive beauty of apartments arises from their character; thus difference of character requires a difference in the composition of the dimensions, and a beautiful form is only produced, when the composition of different proportions is such as to produce one pure and unmingled expression.

3. A third cause of the difference of our opinions of the beauty of proportions, arises from the destination of the apartment; and this, as in the hall, saloon, antichamber, drawing-room, dining-room, library, chapel, &c. requires different proportions, and these depend jointly upon utility and character.

Kinds of fitness.

The observations offered on the beauty of the internal proportions of architecture, afford sufficient evidence for concluding, in general, that the beauty of these proportions is not original and independent, but that it arises in all cases from the expression of some species of fitness. The fitness which such proportion may express, is of different kinds; as,

"1. One beauty of these proportions arises from their expression of fitness for the support of the weight imposed.

"2. A second source of their beauty consists in their expression of fitness for the preservation of the character of the apartment.

"3. A third source of their beauty consists in their expression of fitness, in the general form, for its peculiar purpose or end.

"The two first constitute the permanent beauty, and the third the accidental beauty of an apartment.

Permanent beauty.

"The most perfect beauty that the proportions of an apartment can exhibit, will be when all these expressions unite, or when the same relations of dimensions which are productive of the expressions of sufficiency, agree also in the preservation of character, and in the indication of use."

Accidental beauty.

Besides the expressions that have now been considered as great and permanent sources of the beauty of forms, there are others which have an observable effect in producing the same emotion in our minds, which may be termed accidental beauty.

Associations of this kind arise from education, from early or peculiar habits of thought, from situation, and from professions; and the beauty they produce is felt only by those whom similar causes have led to the formation of similar associations. When these associations are common to many individuals, they sometimes become superior to the more permanent principles of beauty, and may for a time determine the taste of nations.

Fashions in furniture.

The succession of the fashions of furniture, is a strong instance of this. Within a few years, the forms copied from the Chinese, the Gothic, and Antique styles, have succeeded each other; and each, in its turn, has been cultivated with equal zeal and success. With the first, were associated all the notions of eastern magnificence; with the second, the adventures and gallantry of the Gothic manners, and all the elegance and splendour of its cathedrals; and, with the third, our imaginations are crowded with the recollection of Grecian and Roman taste.

Conclusions.

From the whole of the foregoing discussions and illustrations, the following conclusions are drawn:

" That the principal sources of the beauty of forms are, 1st, The expression which we connect with peculiar forms, either from the form itself, or the nature of the subject formed. 2dly, The qualities of design, and fitness, and utility, which they indicate; and, 3dly, The accidental associations which we happen to connect with them.

All forms are either ornamental or useful.

I. The beauty of merely ornamental forms appears to arise from three sources:

1. The expression of the form itself.
2. The expression of design.
3. Accidental expression.

" The real and positive beauty, therefore, of every ornamental form, will be in proportion to the nature and the permanence of the expression by which it is distinguished. The strongest and most permanent emotion, however, we can receive from such expressions, is that which arises from the nature of the form itself. The emotion we receive from the expression of design, is neither so strong nor so permanent, and that which accidental associations produce, perishes often with the year which gave it birth. The beauty of accidental expression is as variable as the caprice or fancy of mankind. The beauty of expression of design varies with every period of the art. The beauty which arises from the form itself, is alone permanent, as founded on the uniform constitution of the human mind. Considering, therefore, the beauty of forms, as constituted by the degree and permanence of their expression, the following conclusions seem immediately to suggest themselves.

1. That the greatest beauty which ornamental forms can receive, will be that which arises from the expression of the form itself.
2. That the next will be that which arises from the expression of design or skill. And,
3. That the least will be that which arises from accidental or temporary expression.

Accidental associations to be sacrificed to permanent expression.

In all those arts, therefore, that respect the beauty of form, it ought to be the unceasing study of the artist to disengage his mind from the accidental associations of his age, as well as the common prejudices of his art, to labour to distinguish his productions by that pure and permanent expression, which may be felt in every age, and to disdain to borrow a transitory fame, by yielding to the temporary caprices of his time, or by exhibiting only the display of his own dexterity and skill."

We conceive that the reader who has attentively considered even this slight sketch of Mr Alison's valuable investigations, will agree with us, that the true principles of architecture have at last been distinctly established; and that the liberal-minded artist will perceive with pleasure, that, instead of being left, as formerly, entangled in uncertainty and confusion, the path to correct practice in his profession is now precisely marked out, and that all his operations are guided by principles as invariable as the constitution of the human mind.

Architecture susceptible of expressions;

From the principles here laid down, it follows, that architecture, as well as sculpture and painting, is perfectly susceptible of distinct expressions of character; that this character may and ought to accord with the situation and purposes for which the edifice is destined; and that all the component parts should tend to promote a full and distinct expression of the general character. For can any thing be more absurd, than to see an edifice appropriated to the sacred purposes of divine worship, composed of a variety of trifling parts, disfigured by gaudy decorations, and neither externally nor internally possessing features expressive of its true character; or, to see what is too frequently met with in buildings appropriated to the most ordinary purposes of life, puny imitations of those forms which ought only to be introduced, of suitable dimensions, in works of magnificence and sublimity; or to find, mixed in the same edifice, forms of expression so opposite as to distract the mind, and completely destroy the intended effect.

frequently violated.

Observations by Professor Stewart.

The following judicious observations of Professor Stewart will account distinctly for the incongruities and bad taste which have occasionally overspread every country in every school of architecture, and which must continue to be the case, unless mankind will benefit by the errors of their predecessors, and be contented to guide their conduct upon true principles. " From the account which has been given of the natural progress of taste, in separating the genuine principles of beauty from the superfluous and offensive concomitants, it is evident there is a limit beyond which the love of simplicity cannot be carried; no bounds indeed can be set to the creations of genius, but as this quality occurs seldom in an eminent degree, it commonly happens, that after a period of great refinement of taste, men begin to gratify their love of variety, by adding superfluous circumstances to the finished models exhibited by their predecessors, or by making other trifling alterations on them, with a view of merely diversifying the effect. These additions and alterations, indifferent perhaps, or even in some degree offensive in themselves, acquire soon a borrowed beauty, from the connexion in which we see them, or from the influence of fashion; the same cause which at first produced them, continues perpetually to increase their number, and taste returns to barbarism, by almost the same steps which conducted it to perfection." (See *Elements of the Philosophy of the Human Mind*, 3d edit. 8vo, p. 373.) But, instead of contemplating the prospect of degeneracy in architecture, may we not hope, by the general dissemination of true principles, to witness a progressive improvement, agreeably to the views taken by the same able and profound philosopher, in page 460 of his *Phil. Essays?*—" The history of taste will be found analogous to that of human reason, the taste of each successive age, being formed on the study of more perfect models than that of the age before it, and leaving in its turn to after times a more elevated ground-work on which they may raise their own superstructure.

Progress of bad taste.

Progress of good taste.

" This traditionary taste (imbibed in early life, partly from the received rules of critics, and partly from the study of approved models of excellence,) is all that the bulk of men aspire to, and perhaps all that they are qualified to acquire. But it is the province of a leading mind to outstrip its cotemporaries, by instituting new experiments for its improvement; and in proportion as the observations and experience of the race are enlarged, the means are facilitated of accomplishing such combinations with success, by the multiplication of those selected materials out of which they are to be formed.

"In individuals of this description, taste includes genius as one of its elements; as genius, in any of the fine arts, necessarily implies a certain portion of taste. In both cases, precepts and models, although of inestimable value, leave much to be done by an inventive imagination.

"In the mind of a man who feels and judges for himself, a large proportion of the rules which guide his decisions, exist only in his own understanding. Many of them he never thought of clothing in language even to himself, and some of them would certainly, if he should attempt to embody them in words, elude all his efforts to convey their import to others."

Such are the views we indulge of the future progress of all human attainments; and as the habits of man would change with his improved condition, there would, in every succeeding age, be still sufficient opportunities for the ingenious architect to exercise cultivated taste and original genius, under the influence of the same unvarying and unerring principles.

Newton's Vitruvius

Besides the authorities already produced, we may further state, that Newton, in the preface to his translation of *Vitruvius*, page vii. says, "I imagine every building should by its appearance express its destination and purpose, and that some character should prevail therein, which is suitable to, and expressive of, the particular end it is to answer; to effect this will require the exertion of the powers of the mind, the force of genius, and solidity of judgment; and without this, a composition is but a compilation of parts, without meaning or end." And again, page viii. "The character or effects which there may be occasion to express in buildings, may be distinguished into the pleasing and elevating, or those of beauty and dignity; the several characters of each class might be ascertained, as well as the kinds and degrees of the sensible properties that will produce the appearance of each character; but it would carry me farther than I intend in this preface, in which I only mean to give a general sketch of my sentiments on this matter, in order to shew the opening there seems to be for a full disquisition of the subject, and the possibility of bringing the art of designing architecture (which at present has no guide but fancy and habit) to some regulation and certainty."

Knight on Taste.

Mr Knight, in his book on Taste, p. 172, says, "that fitness depends upon the association of ideas, and symmetry more so." And again, p. 182, "that imitators err in copying effects instead of studying and adopting principles, disregarding all those local, temporary, or accidental circumstances, upon which their propriety or impropriety, their congruity or incongruity depends; which principles in art are no other than the trains of ideas which arise in the minds of the artist, out of a just and adequate consideration of all such circumstances, and direct him in adapting his work to the purposes for which it was intended; consequently, if either of those circumstances or purposes change, his ideas must change with them, or his principles will be false, and his works incongruous."

Illustrations.

Both Newton and Knight confirm the doctrine of association; but it is Mr Alison alone who explains distinctly the means by which we are to determine and attain the various characters which it is necessary to establish. The attentive artist, by studying what has been said respecting colour and form, but more especially the latter, will be enabled to select features suitable to the character of his edifice. He will perceive that large, square, angular forms, composed of straight outlines, are expressive of power, harshness, strength, and durability, and that such are found in the temples, palaces, pyramids, and gigantic statues of Upper Egypt; also in the bold projecting porticos of the rectangular temples of Greece, placed upon broad platforms, and consisting of strongly marked parts.

Power.

Durability.

Gaiety.

It will also be evident, that slender, curved, and winding lines are expressive of gaiety and lightness: to exemplify this, we may mention the whole of tent architecture, also a great portion of the decorations of ceiling, friezes, and pannels, whether executed in sculpture, stucco, or painting. The tripod form, also, by diminishing in dimensions towards the base, is expressive of the reverse of weight and stability.

In decorative sculpture, both these distinctions are strongly marked; the first by the bold and square outlines in the statues of Olympian Jupiter, and the last by the delicate flowing outlines of Greek statues of fauns, nymphs, and graces.

Richness.

Richness will be expressed by the value of the materials, and the quantity and dexterity of labour bestowed upon them. As it is not in modern Europe the custom in architecture to work much in metals, it has therefore been by marbles, highly polished and dexterously sculptured, that this art has been chiefly enriched. But in former times, when metal was introduced amongst the ancient Romans, and the later Eastern nations, and as it is at present in chimneys, it is the quantity of labour and art bestowed upon nice cutting, high polishing, and delicate engravings, which commands our admiration. Even materials less costly are converted into objects of regard, by the hand of art being liberally bestowed upon them. For we see that sandstone and stucco, by being formed into sculptured mouldings, highly worked Guilochi and fret-work, become expressive of richness. And nothing of this sort is a more convincing proof of the truth of the doctrine of association, than the indenting or inlaying of different kinds of woods and marbles, which are always valued in proportion to their rarity, and the quantity and dexterity of labour bestowed upon them; and their particular character is determined by the shape and substance of the forms into which they are disposed.

Sublimity.

Sublimity is strongly exemplified in the lofty dome, spire, and embattled tower; and these, besides the associations of the expense, power, and design necessary in their construction, have our veneration increased by their antiquity, and appropriation to the purposes of religion and war.

Conclusion.

These slight observations, with the recollection of what has already been said of the relative beauty of fitness and utility, will lead the reader, interested in such speculations, to pursue the subject to a greater length than can be afforded in a work of this nature. He will be at no loss to select abundance of examples from works in every school of architecture; and by duly appreciating the principles here laid down, he will be enabled to produce original designs, which cannot fail of commanding the admiration of mankind.

PART III. PRACTICE OF ARCHITECTURE.

Practice.

IN treating of the practice of architecture, we shall, as nearly as circumstances admit, pursue the same track which we have followed in its history.

General remarks.

In what regards the ancient works of Egypt, India, and Persia, no certain account of the modes adopted in constructing them having reached modern times, we are only enabled to give some account of the general forms and constituent parts of public edifices which now exist, or have been described; leaving the reader, from these data, and the circumstances connected with their situation and history, to draw his own conclusions. What relates to Chinese, Greek, and Roman edifices, is more abundant; and that of the more recent and present ages, as it is to us the most important, will likewise be found the most ample.

EGYPTIAN ARCHITECTURE.

Egypt.

Tapering walls. Huge pillars. Fine sandstone; some calcareous; seldom granite.

Columns bundles of lotus.

Egyptians did not copy others.

Modified.

In the practice of architecture, Upper Egypt appears to have borrowed nothing from any other nation: it is the result of a powerful people attaining their objects by the simplest means. Their most ancient buildings are composed merely of tapering walls, with pillars of huge dimensions placed in the intermediate spaces, to support a roof constructed with large flat stones, all of the kind of stone found in the immediate neighbourhood; that is to say, in a few instances of calcareous, but chiefly of fine sandstone; for, as we have formerly remarked, it was not until after the translation of the empire to Thebes, that granite was employed, excepting in obelisks and colossal statues. The workmanship of Karnac and others of the ancient buildings, has also a rudeness which bespeaks an infancy of the arts. Yet even in this earliest stage, the columns are representations of bundles of the lotus (or lily of the Nile): and the sculptured hieroglyphics are wholly taken from Egyptian mythology, astronomy, historical events, and agriculture; they have evidently arisen from the peculiar situation and circumstances of that particular people; and so far were the Egyptians from being influenced by the practice of the neighbouring nations, that the outlines of the façades and sculptures found in their apparently oldest temples were, with some improvement in the workmanship, preserved nearly the same, till the destructive inroad of Cambyses.

Thebes.

Palace and temple united.

In our historical sketch, the principal circumstances relating to Karnac, Luxor, and the Memnonium, were briefly described: These, from the nature of the sculptures and distribution of the apartments, have by some been supposed to have been royal edifices. At all other places, the ancient buildings are considered as having been appropriated to religious purposes. But, from the accounts handed down respecting the nature of the authority exercised by the Egyptian priesthood, it is probable that even at Thebes the palace and temple were united. We shall therefore proceed to mention the principal dimensions and features of the most noted of these ancient buildings, and introduce such observations as, with the aid of the annexed Plates, will enable the reader to form a tolerably distinct idea of their mode of construction and appropriation.

Practice.

Tentyra. PLATE CXLVIII.

Dimensions of the temple of Isis.

Zodiac.

Capitals heads of Isis. PLATE CL. Fig. 2.

Sanctuary.

Staircase.

Zodiac on terrace or roofs.

TENTYRA, (see Plate CXLVIII.) which contained the most perfectly executed of the Egyptian temples, is situated upon the Lybian shore of the Nile, at the distance of about half a league from the river. The principal temple was consecrated to Isis. The façade is 72 paces in breadth, 145 in depth, and 70 feet in height. A doorway, of elegant form and workmanship, conducts into a portico 60 paces by 30, supported by 24 columns, seven feet diameter, and 55 in height. This portico has zodiacs painted on the ceiling. The hall, which succeeds the portico, is 24 paces square. It is supported by six columns, whose capitals are each composed of four figures of the head of Isis with the ears of a cat (See Plate CL. Fig. 2.); the second hall is 24 paces by 10; the third is of the same dimensions. The apartment which succeeds the last hall is 24 paces by 6, and is insulated by a space on each side of it; this is probably the sanctuary. In the before mentioned second hall, there are two staircases, which lead to the terrace or roof; the steps are each 20 inches broad, and 2 inches high; upon this terrace there is a small apartment 9 feet square, having a very full and perfect zodiac painted on the ceiling. In one of the interior courts of the temple, there is a zodiac which occupies one half of the ceiling of the last mentioned hall, which seems entirely devoted to astronomy; the zodiac is divided from another astronomical picture by the figure of a woman. Behind this great temple is a small one, also consecrated to Isis; it is about 17 paces square. To the right of the door of the great temple, is a periptere temple about 34 paces square, dedicated to Typhon: Fifty paces from the north door is another periptere temple, which appears never to have been finished.

Apollinopolis.

Description.

Length.

In the temple at APOLLINOPOLIS (or Edfou), which, next to Thebes, is the largest edifice in Upper Egypt, the two moles at the entrance are nearly in contact; the doorway is higher than in any other temple; it opens into a vast court, surrounded by columns, in form of a peristyle; the lodging for the priests were behind the peristyle. The portico is formed of six columns in front, and three deep; some of the capitals have three rows of leaves approaching to the Corinthian. The interior distribution is similar to Tentyra. This edifice is 500 feet in length, and is constructed of fine sandstone.

PLATE CXLVIII.

The entrance to Latopolis, as will be seen, (Plate CXLVIII.), is exceedingly fine. It consists of 24 elegant columns, whose capitals vary as to decoration, but are each of masterly execution; being an evidence of the improved state of sculpture; and that, if unfettered by monastic regulations, the artists would have risen to superior excellence. It is also worthy of remark, that in a small temple on the right bank of the Nile, a gallery passes round it in the thickness of the wall; a circumstance, which points out an origin or coincidence with sacred edifices of more modern times, in the western world.

Hermopolis.

Portico.

At HERMOPOLIS, there still exists a magnificent portico, consisting of 12 columns in two rows, each eight feet diameter, and standing at the distance of one diameter from each other, excepting in the middle, which is more. The length of this portico is 120 feet, and the height 60 feet. Each of the columns represents a bundle of the lotus tied together.

Difference in plans.

There appears to have been a considerable difference in the form of the ground plans of the Egyptian edifices. The entrance to Luxor is composed of two obelisks, which at present rise 70 feet above the surface of the ground, and are understood to be about 30 below it; two colossal statues of black granite, each 38 feet high; and two great moles or masses of building, of an oblong plan, and tapering sides, 55 feet high, and covered with hieroglyphics. And so closely are these large masses crowded together, that from the front of the moles to that of the obelisks, the distance is only 14 paces. The edifices at Karnac, Philee, and Hermopolis, have also large moles at their entrances, and the doorways are between their moles. To these succeed courts with peristyles, or covered passages, which lead to the grand porticos. In these instances, the number and magnitude of the parts appeared to have been chiefly had in view; but at Tentyra and Latopolis, there does not appear to have been any of these great objects at the entrance; it leads immediately into a beautiful portico, characterised by richness and perfection of workmanship. In some of these edifices, the sanctuary is placed at the extremity from the entrance; and, in others, it has courts and halls on each side of it. Whether these differences in arrangement arose from a gradual change of style, or whether each form was peculiar to the deity or purpose to which it was appropriated, it is now impossible to determine; but the perfection of the workmanship at Tentyra, Latopolis, and Apollinopolis, is incontrovertible evidence of an improved state of the arts.

In decoration.

Plate CXLIX.

Plate CL. Fig. 1, 3, 4, 5, 6.

Fig. 2.

In the outlines and decoration of their columns, the changes have also been very considerable. In the simplest, as those at the entrance of the tombs at Silsilis, (see Plate CXLIX.) they consist of representations of bundles of reeds bound together near the top with a cord, which is wound several times round them, having a square stone laid on their top, forming what is now known by the term abacus; and the part between this stone and the cord binding, apparently crushed down by the incumbent weight, so as to bulge out a little beyond the surface of the part which is firmly bound. The first change from this simple mode seems to have been to introduce mere bindings or belts in various parts of the shaft; and in the divisions between them, to represent alternately reeds and hieroglyphics. The bulged part near the top was also decorated by reeds and hieroglyphics, and sometimes by triangular flutings. Afterwards, this upper part was formed into elegant vase-shapes, decorated with the stalks, leaves, buds, and blossoms, of the lotus or lily of the Nile; and, occasionally, leaves of the palm, vine, papyrus, and date were introduced. (See Plate CL. Fig. 1, 3, 4, 5, 6.) At Tentyra, each capital is composed of four heads of the goddess Isis; and here the abacus, instead of being a plain square thin stone, projecting beyond the surface of the shaft, (as at Silsilis), is of a cubical form, only equal to the diameter of the column, and decorated with hieroglyphics, as was the whole surface of the shaft. (See Plate CL. Fig. 2.) At Tentyra, the shaft was continued, of equal diameter, quite down to the ground; but at Latopolis, and several other places, it was made narrower, just at the bottom, and was placed upon a square or rounded plinth. At the Memnonium, in place of columns, human figures are introduced, as they were afterwards by the Greeks, who pretended to have invented and named them Caryatides. (See Plate CXLIX. Fig. 2.)

Caryatides.
Plate CXLIX.
Fig. 2.

Outlines of edifices.

Entablature.

Sculpture.

In the general façades, the shapes remained nearly the same; the extremities of the space in which the front row of columns of the portico was placed, were terminated by perpendicular lines; but at the extremities of the façade, the lines at the external angles were always tapering. Upon each angle there was an astragal, or large bead, which returned horizontally along the top of the lintel or architrave; this architrave at Tentyra is three-fourths, and at Latopolis two-thirds of the diameter of the column. The general crowning member of the façade is always a very large cavetto, having a comparatively small projection, and decorated with vertical flutings or reeds; and, frequently, in this member, and sometimes on the architrave, over the entrance doorway, were sculptured the wing, globe, and serpent. The whole of the walls, externally and internally, were covered with hieroglyphics; and, it appears probable, that the general mass of building was first constructed, and the sculptures performed afterwards. The progress of the art of sculpture is very evident, from the different states in which it was found, being, 1st, A simple outline, cut very deep. 2d, Figures in very low relief, and of rude execution. 3d, Figures very bold and perfect, as at Tentyra; and, 4th, A sort of ornament, adopted by the Greeks and Romans, and known, in modern times, by the name of abarasque; but in no instance did any of those hieroglyphics or ornaments interfere with the outlines of the building, all of which have been carefully preserved; and this circumstance alone, tends, in no small degree, to produce that imposing effect so peculiar to Egyptian architecture.

Tombs.

Plate CXLIX.

It has already been observed, that amongst the ancient Egyptians, the sepulchre or tomb was considered their everlasting dwelling, and that the trouble and expence bestowed upon it, and upon preserving the bodies of their relations, occupied much of the time and attention of the living. Near principal cities are regularly found extensive ranges of tombs. In Upper Egypt, they were formed by excavations in the sides of the adjacent rocky mountains, (see Plate CXLIX.), into extensive galleries and halls, with smaller apartments for sarcophagi and mummies; and these, in many instances, were decorated with columns, sculptures and paintings, executed in the most masterly manner, and forming a striking contrast with the rudeness of the surrounding rocky desart. They were also disposed in successive gradations, evidently suited to the different ranks of society. But partaking more of the nature of sculpture than architecture, and also forming so extensive and interesting a subject of discussion, they require to be treated separately, which can be done with most propriety under the word Sepulchre, where not only the Egyptian, but those of other nations, will be fully explained and illustrated.

Memphis.
Pyramids.
Sphinx.

The total annihilation of Memphis, Heliopolis, and other structures, at the northern extremity of this wonderful valley, has left us only the pyramids, the enormous sphinx, with vestiges of a great causeway, and some tombs, as specimens of the power which reigned in the second capital; but these alone, after the expiration of 3000 years, are sufficient to excite astonishment. Some particulars relating to them have already been furnished in the historical Part; but as a full discussion, in all its bearings, does not fall under this article, we must, for that species of information, refer the reader to the word Pyramids.

Alexandria and Cairo.

Although Alexandria and Cairo have occupied distinguished places in the annals of Egypt, yet possessing little that is connected with its ancient architecture as a distinct school, and that little having been pillaged from the treasures of the Thebaid, it would be quite improper here to enter into any details respecting these splendid cities.

The works connected with the navigation of the Nile, their extensive canals and reservoirs, will be treated of under Inland Navigation and Ports.

General observations.

But previous to our dismissing the subject of Egyptian architecture, it may not be improper to introduce the following general observations. Although we have not any direct account of the manner in which the immense masses of stone which composed the antient edifices were raised from the quarries, carried to, and placed in their respective situations; yet it is evident, from the vestiges of the communications made from the Nile into the extensive quarries on its banks, as at Apollinopolis, Elephantina, Philee, and other places, that advantage had been taken of the annual rise of that river, to raise and float the great blocks which they employed. In all that regards the operations which afterwards took place, in removing them from the water to the building, preparing them for, and placing them in their several positions, such as raising obelisks and columns of great magnitude, and covering the latter with platforms which composed their terraces and roofs, we are left wholly to conjecture. In the course of such continued and extensive experience, it is natural to conclude, that whatever was the mode they had adopted, they had arrived at a great degree of perfection; but for the last two thousand years, the oppressed and enslaved natives have been as little qualified to explain in what manner the entrance to Luxor was constructed, as, at this day, the Greeks of Attica are respecting the buildings in the Acropolis of Athens. If descriptions, or intelligence of any kind, were ever committed to writing, they must have been destroyed by Cambyses, the Romans, or Amrou. What the Greeks drew from thence is very indistinctly acknowledged; for that vain people, as they had a just claim to much, endeavoured to arrogate original merit to themselves in all that regards architecture. Although the size and quality of the materials, and the principles of construction, are calculated to ensure durability, yet it must be confessed, that the climate is also equally favourable; for even Egyptian structures could not have withstood the effects of our frequent and severe changes of atmosphere during 3000 years.

Climate favourable.

Plutarch.

Plutarch, who travelled to Egypt with the view of investigating all that the priests taught respecting Osiris and Isis, describes their temples as having long wings, and extensive open avenues; and also as having secret and dark vestries, resembling the adyta of the Thebans. The result of the researches by modern scientific travellers amounts to nearly the same. Indeed, the local circumstances of the country and people, led unavoidably to the style which was adopted; there being no rain, it was chiefly on account of shade that the covering parts were required; their total ignorance of the principles of an artificial arch forced them to use large flat stones; their quarries afforded materials of any magnitude, and they had probably previously inhabited, or at least worshipped in caverns, first natural, and perhaps afterwards artificial; and these circumstances, with the applications of wealth and power in the hands of a numerous priesthood, with cloistered habits, and, for many succeeding ages, pursuing incessantly the same objects, seem to afford a sufficiently satisfactory explanation of the rise and progress of Egyptian architecture.

Modern travellers.

Shade wanted.

Montfaucon is of opinion, that Cambyses established the Mithratic worship in Egypt about 500 B. C. What seems to have chiefly suggested this idea, is the discovery of a curious representation of a sacrifice to the sun, in an artificial cavern near the ruins of Babain in Upper Egypt. It is hewn out of a rock in the middle of the mountain; it is about 50 feet wide, and as much in height, and between five and six feet in depth. The sun appears encompassed with rays, forming a circle 15 or 20 feet in diameter. Two priests, of a natural stature, their heads covered with long caps, terminating in points, stretch their hands towards the sun; the ends of their fingers touch the rays; two little boys, clothed like the priests, stand by their sides, and reach to them two great goblets; below the sun there are lambs killed, and extended on piles consisting each of ten pieces of wood; and below the piles are seven jars or diotas. On the other side of the sun there are two women and two girls, in full relief, joined to the rock by parts of their backs and feet only; behind and above these and the boys are several hieroglyphics. The tiara on the head of the priests very much resembles those of the Persians in a procession in the bas reliefs, found at Chilminac near Persepolis. The hawk and Ibis are purely Egyptian. This is a very curious monument, and is well deserving of attention. The whole is certainly very different from the other excavations in Upper Egypt.

Mithratic worship.

Singular cavern.

INDIAN ARCHITECTURE.

In regard to the practice of architecture in India, we must refer to the Historical Part for particulars respecting the cities of Oude, Canouge, Delhi, and Làhôre; and shall here only make an addition to the description of Agra.

India.

Cities.

It was built in the form of a crescent along the banks of the Jumna; its walls were constructed with stones of great size, hard, and of a reddish colour resembling jasper. It was four miles in extent, and consisted of three courts, with many stately porticos, galleries, and turrets, all richly painted and gilt, and some overlaid with plates of gold. The first court was built round with arches which afforded shade; the second was for the great Omrahs and ministers of state, who had here their apartments for transacting public business; and the third court, within which was the seraglio, consisted entirely of state apartments of the emperor, hung round with the richest silks of Persia. Behind these were the royal gardens. In front of the palace towards the river, a large area was left for the exercise of the royal elephants, and for battles of the wild beasts; and in a square which separated the palace from the city, a numerous army lay constantly encamped. Mandesto, who visited Agra in 1638, then in the zenith of its glory, says, it was surrounded by a wall of freestone and a broad ditch, with a draw-bridge at each of its gates. He states, that at the further end of the third court, under a piazza, were a row of silver pillars; that beyond this was the presence-chamber, with golden pillars; that within a balustrade was the royal throne of massy gold, almost incrusted with diamonds, pearls, and other precious stones; that above this throne was a gallery where the Mogul appeared every day at a certain hour, to hear and redress the complaints of his subjects; and that no person but the king's sons were admitted behind these golden pillars. He mentions also an apartment remarkable for its

Agra built in the form of a crescent.

Courts, porticos, galleries.

State apartments.

Pillars of silver and gold.

tower, which was covered with massy gold, and for the treasure it contained, having eight large vaults filled with gold, silver, and precious stones. Tavernier, who visited Agra near the end of the 17th century, and in the absence of the court had permission to examine the inside, describes a gallery, the ceiling of which was decorated with branched-work of gold and azure, and the walls hung with rich tapestry. The gallery which fronted the river, the monarch had proposed to cover over with a sort of lattice-work of emeralds and rubies, to represent grapes with their leaves, when they are green, and when they begin to grow red; but this design then remained imperfect, there being only three stocks of a vine in gold, with their leaves, enamelled with emeralds and rubies, representing grapes; being a specimen of what was intended for the whole.

Tavernier.

Lattice work, rubies, &c.

We have been thus minute in the description of the palace of Agra, because, having been built by one of the most enlightened princes of the East, it affords a perfect specimen of the scale upon which the monarchs of those extensive and rich countries acted. And it will be allowed, that the establishments of Akbar and his great rajahs, occupying four miles along the banks of the Jumna, and connected with a handsome and prosperous city, must have produced a picture sufficiently splendid, and emblematic of the wealth and power of the prince who erected it.

Cuttack palace.

Nine courts.

At CUTTEK, or Cuttack, the capital of Orissa, there is a fine palace. It consists of nine distinct buildings:—1. For elephants, camels, horses. 2. For artillery, military stores, and quarters for the guards. 3. For porters and watchmen. 4. For artificers. 5. For kitchens. 6. For the Rajah's public apartments. 7. For the transaction of private business. 8. Where the women reside. 9. The rajah's sleeping apartments.

The specimens here selected being the most noted, will, we trust, convey an idea of the nature of the Indian cities and palaces; and we shall therefore proceed to consider,

Temples.

Five different forms.

II. *Their sacred edifices.* We have already stated, that these were of five different sorts; that is, 1. Pyramids; 2. Excavations; 3. Square or oblong courts; 4. In the form of a cross; and, 5. Perfectly circular.

Pyramids.

1. We are here at a loss, equally as in the case of Egypt, to determine whether or not the construction of Indian pyramids preceded that of their excavations. To construct a pyramid of rude stones, is certainly a much simpler operation than forming a cavern ornamented with sculpture; so that although it may be conceived that mankind might, for the purposes of worship, make use of the simple plain cavern, either natural or artificial, previous to the construction of buildings of great magnitude on the surface, yet it is not very probable that the splendid excavations of Elephanta and Vellore, in which were rich sculptures, and even pyramids cut out of the solid rock, could have preceded a rude pyramid on the surface. But as the purposes to which the pyramids of Deogur and Tanjore are appropriated partake very much of the nature of the cavern, their entrance-doors being very small, their interior being lighted by means of lamps, and the middle chamber by one lamp only; there is some reason for supposing, that, in places where rocky eminences were not conveniently situated, or from motives now unknown, some change of ideas taking place, these pyramids might be constructed for purposes similar to the original cavern or grotto, in the same manner as the Egyptian pyramids are considered to have been done with regard to the tombs of the Thebaid. The external faces of the pyramids of Deogur and Tanjore are very rude, as will be shewn under the word PYRAMID, to which we must refer the reader.

Excavations.

2. In regard to excavations, they are numerous and extensive. In some instances, they are very simple and plain; in others, highly ornamented with architectural forms and sculptures. From Captain Wilson's paper in the 6th vol. of the *Asiatic Researches*, we learn, that an extensive branch of the Caucasus was named by the Greeks, Parapamis, from *Para Vami*, the pure and excellent city of Vami, commonly called Bamaiya. It is situated on the road between Balkh and Cabul, where vast numbers of apartments are cut out of the rocks, some of them so large as to be supposed temples. And Abul Fazel says, that in the Soubah of Cashmere, in the middle of the mountains, 12,000 apartments were cut in the solid rock. At this place there were 700 places where the figure of a serpent was sculptured. Although neither the precise form nor dimensions are given, yet from the great number of excavations, and the place being noticed by the Greeks, it must have, in former ages, been of importance at least for its sanctity; and its situation between India and Persia, renders it still an interesting subject of enquiry.

City of Vami.

The serpent.

In other parts of India, the excavated temples have fallen more frequently under the observation of well-informed scientific persons, who have, with laudable industry, furnished the public with exact representations, and full details respecting them. The three principal ones, and which our limits will only enable us to notice, are, Elephanta, Salsette, and Vellore or Ellora.

Elephanta.

ELEPHANTA is situated near Bombay, in an island so named from the figure of an elephant being cut upon the rocks on the south shore. The grand temple is 120 feet square, and supported by four rows of pillars; along the side of the cavern are from 40 to 50 colossal statues from 12 to 15 feet high of good symmetry, and, though not quite detached from the rock, boldly relieved; some have a helmet of pyramidal form, others a crown decorated with jewels and devices, and others have only bushy ringlets of flowing hair; many of them have four hands, some six, holding sceptres, shields, symbols of justice and religion, warlike weapons and trophies of peace; some inspire horror, others have aspects of benignity. The face of the great bust is 5 feet long, and the breadth across the shoulders 20 feet.

At the west end of this great pagoda is a dark recess 20 feet square, totally destitute of ornament; the altar is in the centre, and there are two gigantic statues at each of the four doors by which it is entered. Niebuhr represents these statues as naked, 13½ feet high, and the sculpture good; their heads are dressed like the other statues, and they have each rich collars round their necks, and jewels in their ears. Hunter states, that, on entering Elephanta, there is a feerandah or piazza, which extends from east to west 60 feet, that its breadth is 16 feet, and that the body of the cavern is on every side surrounded by similar feerandahs. (*Archæol.* vol. vii. p. 287.)

Canara or Salsette.

Canara, in the island of SALSETTE, which is situated also near to Bombay, is represented by Linschotten, who visited it in 1759, as being like a town. He describes the front as hewn out of the rock into four stories or galleries, in which there are 300 apartments; these apartments have generally an interior recess or sanctuary, and a small tank for ablution. In these recesses, as at

Dimensions.

Sculpture.

Elephanta, are representations of the Lingam deity. The grand pagoda is 40 feet high to the soffit of the arch or dome; it is 84 feet long, and 46 broad. The portico has fine columns decorated with bases and capitals: immediately before the entrance into the grand temple are two colossal statues 27 feet high, which have mitre caps and ear-rings. Thirty-five pillars of an octagonal form, about 5 feet diameter, support the arched roof of the temple; their bases and capitals are composed of elephants, horses, and tygers, carved with great exactness. Round the walls two rows of cavities are placed with great regularity for receiving lamps. At the further end is an altar of a convex shape, 27 feet high, and 20 in diameter; round this are also recesses for lamps, and directly over it is a large concave dome cut out of the rock. Immediately about this grand pagoda, there are said to be 90 figures of idols, and not less than 600 within the precincts of the excavations.

Mr Grose.

Mr Grose, who visited India in 1750, seems to be of opinion, that the labour required to construct Elephanta and Salsette, must have been equal to that of erecting the pyramids of Egypt; and though it is not mentioned which of the many pyramids he refers to, the remark sufficiently expresses his admiration of the greatness of these Indian works. He observes, (p. 92.) that the roof of Elephanta was flat; that of Salsette of an arch form, supported by rows of pillars of great thickness, arranged with much regularity; that the walls are crowded with figures of men and women, engaged in various actions in different attitudes; that along the cornice there are figures of elephants, horses, and lions, in bold relief; and above, as in a sky, Genii and Dewtah are seen floating in multitudes.

Ellora.

But magnificent as the excavations at Elephanta and Salsetta must appear, they are still surpassed by those near *Vellore*, *Ellore*, or *Ellora*, which is situated 18 miles from Aurungabad, capital of the province of Balagate, N. Lat. 19° 20′, E. Lon. 75° 30′.

Sir C. Mallet, in a paper he transmitted to the president of the Asiatic Society, and published in the sixth volume of their Researches, gives a detailed account of 16 of them.

Sixteen excavations.

1. Jugnath Subba.
2. Adnaut Subba.
3. Indur Subba.
4. Pursuram Subba.
5. Doomar Lyna.
6. Jun Wassa.
7. Comar Wana.
8. Chana, or oil shop.
9. Neelkunt Mah dew.
10. Ramish wur.
11. Kylas, or Paradise.
12. Dus Outar.
13. Tee Tal.
14. Bhurt Chutturghun.
15. Biskurma, or carpenter's hovel.
16. Dehr Wanar, or Hallulcore's quarters.

Plates CLI. CLII.

Of these we must, of course, confine ourselves to such parts as are calculated to convey generally an idea of their architecture; with this view, we have selected for engravings (See Plates CLI. and CLII.) the ground plan of Kylas, the entrance and section of Biskurma, the elegant entrance to the cave of Jugnath Subba, the temple of Indur Subba, and a singularly beautiful piece of sculpture at the door of Jun Wassa. We shall also give the description and dimensions of the Kylas and the Biskurma.

Kylas.

Kylas, alias Paradise, (aspect, west.) This wonderful place is approached more handsomely than any of the foregoing, and exhibits a very fine front in an area cut through the rock. On the right hand side of the entrance is a cistern of very fine water. On each side of the gateway there is a projection reaching to the first story, with much sculpture and handsome battlements, which, however, have suffered much from the corroding hand of time. The gateway is very spacious and fine, furnished with apartments on each side that are now usually added to the dewrics of the eastern palaces. Over the gate is a balcony, which seems intended for the Nobut Khanneh. On the outside of the upper story of the gateway are pillars that have much the appearance of a Grecian order. The passage through the gateway below is richly adorned with sculpture, in which appear Bouannee Ushtbooza on the right, and Gunnes on the left. From the gateway you enter a vast area cut down through the solid rock of the mountain, to make room for an immense temple of the complex pyramidal form, whose wonderful structure, variety, profusion, and minuteness of ornament, are too minute for description. This temple, which is excavated from the upper region of the rock, and appears like a grand building, is connected with the gateway by a bridge left out of the rock as the mass of the mountain was excavated. Beneath this bridge, at the end opposite the entrance, there is a figure of Bouannee sitting on a lotus, and two elephants with their trunks joined, as though fighting over her head. On each side of the passage under the bridge, is an elephant, marked (*a*) in the Plan, one of which has lost its head, the other its trunk, and both are much shortened of their height by earth. There are likewise ranges of apartments on each side behind the elephants, of which those on the left are much the finest, being handsomely decorated with figures. Advanced in the area, beyond the elephants, are two obelisks (*b*) of a square form, handsomely graduated to the commencement of the capitals, which seem to have been crowned with ornaments, but they are not extant, though, from the remains of the left hand one, I judge them to have been a single lion on each.

To preserve some order, and thereby render easier the description of this great and complex work, we shall, after mentioning that on each side of the gateway within there is an abundance of sculpture, all damaged by time, proceed to describe the parts of the centre structure; and then, returning to the right side, enumerate its parts; when, taking the left hand, we shall terminate the whole in a description of the end of the area opposite to the gateway, and behind the grand temple, exemplifying the whole by references to the annexed plan.

Centre below. Passing through the gateway (1) below, you enter the area (2), and proceeding under a small bridge, pass a solid square (3) mass, which supports the Bull Nundee stationed above: the sides of this recess are profusely sculptured with pillars and figures of various forms. Having passed it, you come to the passage under another small bridge, beneath which there is, on one side, a gigantic figure of the Rajah Bhoj, surrounded by a groupe of other figures, opposite to which is a gigantic figure of Guttordhuj, with his ten hands. At each end of this short passage commences the body of the grand temple (4), the excavation of which is in the upper story, that is here ascended by flights of steps on each side (5).

Right and left hand sides of the temple below. The right hand side is adorned with a very full and complex sculpture of the battle of Ram and Rouon, in which Hunomaun makes a very conspicuous figure. Proceeding from this field of battle, the heads of elephants, lions, and some imaginary animals, are projected as though supporting the temple, till you come to a projection (6), in the side of which, sunk in the rock, is a large groupe of figures, but much mutilated. This projection was connected with the apartments on the right hand side of the area by a bridge (7), which has given way, and the ruins of it now fill up the sides of the area. It is said to be upwards of 100 years since it fell.

Passing the projection of the main body of the temple, it lessens for a few paces, then again projects (8), and after a very small space on a line of the body of the temple, the length of this wonderful structure, if what is fabricated downwards out of a solid mass can be so called, terminates in a smaller degree of projection than the former. The whole length is supported, in the manner above mentioned, by figures of elephants, lions, &c. projecting from the bases, to give, it should seem, the whole vast mass the appearance of moveability by those mighty animals. The hindmost or eastern extremity of the temple, is composed of three distinct temples, elaborately adorned with sculpture, and supported, like the sides, by elephants, &c. many of which are mutilated. The left hand side (I mean from the entrance) differs so little from the right, that it is unnecessary to be particular in mentioning any thing, except that opposite the description of the battle of Ram and Rouon, is that of Keyso Pando, in which the warriors consist of footmen, and others mounted on elephants, and cars drawn by horses, though none were mounted on horses. The principal weapon seems the bow, though maces and straight swords are discoverable.

Centre above. The gateway consists of three centre rooms (9), and one on each side (9). From the centre rooms, crossing the bridge (10), you ascend by seven steps (11) into a square room (12), in which is the Bull Nundee. This room has two doors and two windows. Opposite the windows are the obelisks (*b*) before mentioned.

From the station of Nundee you cross over the second bridge (13), and ascend by three steps (14) into a handsome open portico (15), supported by two pillars (above each of which, on the outside, is the figure of a lion, that, though mutilated, has the remains of great beauty; and on the inside, two figures resembling sphynxes) towards the bridge, and two pilasters that join it to the body of the temple, the grand apartments of which (16) you enter from the portico by four handsome steps and a doorway, on each side of which are gigantic figures. Advancing a few paces into the temple, which is supported by two rows of pillars, besides the walls that are decorated with pilasters, there is an intermission of one pillar on each side, leading to the right and left to an open portico (17), projecting from the body of the temple; from the right hand one of which, the bridge already mentioned as broken connected the main temple with the side apartments, to which there is now no visible access, but by putting a ladder for the purpose; though I was told there is a hole in the mountain above that leads to it, which I had not time nor strength to explore. The access to the opposite is by stairs from below. The recess (18) of the Ling (19) of Mahdew, to which there is an ascent of five steps, forms the termination of this fine saloon, on each side of the door of which is a profusion of sculpture. The whole of the ceiling has been chunamed and painted, great part of which is in good preservation.

A door (20) on each side of this recess of the Ling of Mahdew leads to an open platform (21), having on each side of the grand centre pyramid that is raised over the recess of the Ling, two other recesses (22), one on each side, formed also pyramidically, but containing no image. Three other pyramidical recesses (23), having no images within them, terminate the platform, all of them elaborately ornamented with numerous figures of the Hindu mythology. Many of the outer as well as the inner parts of this grand temple are chunamed and painted. The people here attribute the smoky blackness of the painting within, to Aurengzebe, having caused the different apartments to be filled with straw and set on fire, which can be reconciled on no other ground than that he meant to efface obscenities, as there are many in the sculptures. Upon the whole, this temple has the appearance of a magnificent fabric, the pyramidal parts of which seem to be exactly in the same style as that of the modern Hindu temples.

Right-hand side of the area. This side of the rock has a continuance of excavations, as marked in the Plan; but all those below, except the veranda, which I shall quit for the present, are of little note; and those above, of three stories, called Lunka (24), which appear much more worthy of attention, are inaccessible, but by a ladder from the fall of the bridge. We shall therefore proceed to the

Left-hand side of the area. In this side there are excavations of some consideration below, from which you ascend to an upper story, called Par Lunka, by an indifferent staircase, into a fine temple (25); at the extremity of which is a recess, containing the Ling of Mahdew; and opposite thereto, near the entrance from the staircase, is the Bull Nundee, with two large fine figures, resting on maces on each side of the recess, in which he sits. The ceiling of this temple is I think lower than any of the foregoing. The whole of this temple is in fine preservation, strongly supported by very massy pillars, and richly ornamented with mythological figures, the sculpture of which is very fine. The ceiling, like the others, has the remains of painting visible, through the dusky appearance of smoke, with which it is obscured. Descending from Par Lunka, you pass through a considerable insculptured excavation (26) to a veranda (27), which seems allotted to the personages of the Hindu mythology, (a kind of pantheon,) in open compartments. These figures commence on the left hand with, 1. The Ling of Mahdew, surrounded by nine heads, and supported by Rouon. 2. Goura, Parwuttee, and beneath Rouon, writing. 3. Mahdew, Parwuttee, and beneath Nundee. 4. Ditto, ditto. 5. Vishnu. 6. Goura, Parwuttee. 7. A Bukta (votary) of Vishnu, with his legs chained. 8. Goura, Parwuttee. 9. Ditto. These representations of Goura and Parwuttee all differ from each other. 10. Ditto. 11. Vishnu and Luchmee. 12. Bal Budder, issuing from the Pind, or Ling of Mahdew. Here ends the left hand side, and commences the east extremity, or end of the area (28), in which the figures are continued, viz. 13. Goura and Parwuttee. 14. Behroo, with Govin Raj transfixed on his spear. 15. Dytaseer on a chariot, drawing a bow. 16. Goura and Parwuttee. 17. Kal Behroo. 18. Nursing Outar, issuing from the pillar. 19. Kal Behroo. 20. Bal Behroo. 21. Vishnoo. 22. Govin. 23. Brimha. 24. Luchmedass. 25. Mahmund. 26. Nunain. 27. Behroo. 28. Govin. 29. Bal Behroo. 30. Govin Raj and Luchmee. 31. Kissundass. Here ends the veranda of the eastern extremity; and we now proceed with that on the right hand (29), having in our description of that side stopped at the commencement of this extraordinary veranda, for the purpose of preserving the enumeration of the figures uninterrupted, viz. 32. Mahdew. 33. Ittuldass. 34. Dhurm Raj embracing Uggar Kaum. 35. Nursing destroying Hurn Kushb. 36. Vishnu sleeping on Seys Naug, the Kummul (Lotus) issuing from his navel, and Brimha sitting on the flower. 37. Goverdhun. 38. Mahdew Bullee, with six hands. 39. Krishna sitting on Gunoor. 40. Bharra Outar. 41. Krishna

Chitterbooz trampling on Callea Naug. 42. Ballaju. 34. Anna Pooma. It is to be observed, that almost all the principal figures are accompanied in their respective pannels by others explanatory of the character of that part of the history of the idol in which it is represented.

Dimensions of the Kylas.

	Ft.	In.
Outer area, broad,	138	0
Ditto, deep,	88	0
Greatest height of the rock, through which the outer area is cut,	47	0
Gateway, height,	14	0
Ditto, breadth, without the modern building,	14	4
Passage of the gateway, having on each side rooms, 15 feet by 9,	42	0
Inner area or court, length from gateway to the opposite scarp,	247	0
Ditto, breadth,	150	0
Greatest height of the rock, out of which the court is excavated,	100	0

Left side of the Court, lower story, viz.

A small cave, in front two pillars, and a pilaster at each end, with three female figures buried up to the knees with rubbish, length,	22	6
Ditto, breadth,	8	0
Ditto, height,	9	8
Another excavation, in front five pillars, two pilasters, length,	57	9
Ditto, breadth, within the benches that are round this cave,	6	0
Ditto, height, at the end of this is a staircase to the upper story,	10	4
Interval unexcavated,	20	0
Another excavation, having two large plain square pillars, and two pilasters in front, with a bench round the inside, the rock projecting beyond the pillars, length,	54	6
Ditto, breadth,	12	6
Ditto, height,	16	0
Doorway, leading to a gallery or veranda, 5 feet 11 inches high, by 2 feet 9 inches wide. Gallery containing figures. Length from doorway to the extreme depth of the whole excavation,	117	8
Ditto, breadth,	13	0
N. B. In this length are eleven pillars, each 2 feet 8½ inches square.		
Ditto, height within the pillars. The projecting rock is about three feet lower, extending irregularly in the course of the length, from 7 to 13 feet beyond the pillars,	14	8

End of the Area, opposite the Gateway, behind the Temple.

Whole breadth from side to side, measuring from the inner wall of the gallery on each side,	186	6
Breadth of the gallery, including the pillars, there being 17 in this range,	13	4

N. B. The rock projects beyond the pillars along this range, and the right hand one irregularly, from 15 to 22 feet, and is lower than the ceiling.

Right hand of the Court, lower story, viz.

Figure gallery, or veranda, of the same dimensions as the preceding parts of the same gallery, for the space of ten pillars, the angle one being included in the foregoing; three of which are broken, it is said, to make trial of the power of the deity of the place; and when it was found, that the superincumbent rock did not sink, the tempter, said to be Aurenzebe, forbore further trial.

	Ft.	In.
Doorway 2 feet 4 inches broad by 5 feet high, leads to a veranda; within this veranda is a room of 60 feet by 22, and 11 feet 4 inches high. Right end unfinished, length,	60	0
Ditto, breadth,	17	0
Ditto, height,	13	0
A small projecting room, 15 feet by 13, and 6 feet high, being choked with several finely sculptured figures. An excavation raised 12 feet from the surface of the court, length,	36	10
Ditto, depth,	14	9
Ditto, height,	12	0

There is a multiplicity of figures in this apartment, detached from the wall. Amongst the rest, a large skeleton figure, with a smaller one on each side. The principal is sitting, with each foot on a prostrate naked figure.

	Ft.	In.
An excavation, which has a small recess, opposite the entrance, of 6 feet by 7, and 8 high, length,	24	0
Ditto, breadth,	18	0
Ditto, height,	10	0
An excavation terminating the lower story, on the side, length,	24	0
Ditto, depth,	10	0
Ditto, height, except between the two pillars, where the roof is arched, (the first instance I have seen of the arch,) and is there 14 feet 8 inches high.	11	6

Left hand side, upper story, viz.

A small unfinished excavation, the dimensions of which were not worthy taking.		
Pur Lunka is a fine large excavation, ascended by a flight of 25 steps, and a doorway of 3 feet 8 inches broad, by 7 feet 7 inches high; length, exclusive of the recess, in which is the temple of Mahdew,	70	7
Ditto, breadth,	61	9
Ditto, height,	14	6
Recess, in which stands the temple of Mahdew, depth,	26	0
Ditto, breadth, (the temple on the outside is 26 by 20 feet,)	39	0

N. B. The whole of this apartment is full of figures, some very finely sculptured; and the centre floor is raised one foot, and the ceiling in proportion.

Right hand side, first story.

	Ft.	In.
A large room, formerly connected with the grand temple by a bridge, now broken down, length,	60	0
Ditto, depth,	18	0
Ditto, height,	16	0
Another room within the foregoing, entered by a door from it, having a bench all round. This inner room is very dark, having no light but from the doorway, length,	36	0
Ditto, depth,	29	0
Ditto, height,	11	0

Right hand side, second story.

Entered by a staircase from the right side of the foregoing, of 24 steps. A large room, of the same dimensions, as a correspondent one below, except two feet less in the height.

Another room within the foregoing,	depth	35	0
Ditto, ...	length	87	0
Ditto, ...	height	14	0

The rock seems to have given way in the centre of this room, and the rubbish has fallen in.

Centre.

Balcony over the gateway 14 feet by 8, and 8 high. A room within it, 9 feet square, and about 9 feet high. Another within it, same dimensions. One on each side from the centre, 22 × 15 each. Bridge 20 feet × 18, with a parapet, 3 feet 6 inches high. Ascent by 9 steps from the bridge into a distinct room, in which is the Bull Nundee, 16 feet 3 inches square. Another bridge, 21 feet × 23 broad, leading to the upper portico of the temple. This portico, with the parapet wall, is 18 feet × 15 feet 2 inches, and 17 high; within a bench that is rounded, of 4 feet high, by 3 feet 7 inches broad. You can enter this portico from the gateway, by a passage that the filling up of the rubbish has afforded; but the proper passage is by flights of steps on each side, *of 36 steps each*, leading up on each side the body of the temple.

Grand Temple.

	Ft.	In.
Door of the portico 12 feet high × 6 feet broad; length from the door of the portico entering the temple to the back wall of the temple, .	103	6
Length from the same place to the end of the raised platform behind the temple, ...	142	6
Greatest breadth of the inner part of the temple,	61	0
Height of the ceiling, ...	17	10

Two porches on each side, measured without, 34 feet 10 inches × 15 feet 4 inches.

The particulars of the intricate measurement of this fine temple will be best understood from the plan formed on the spot.

Height of the grand steeple or pyramid computed about 90 feet from the floor of the court, and of the smaller ones about 50; height of the obelisks about 38 feet; base 11 feet square, being 11 feet distant from each side of the room in which is the Bull Nundee. The shaft above the pedestal is 7 feet square. The two elephants on each side the court or entry are larger than life."

BISHURMA, OR VISWAKURMA KA JOOMPREE.

The Carpenter's Hovel. Front W. 5 S.

According to the legend, Bishurma * was the artist who fabricated the whole of these wonderful works in a night of six months; but the cock crowing before they were finished, they remained imperfect, and he retired, having wounded his finger, to this hovel, in which state, the figure in front (1) of the entrance of this beautiful excavation, is said to be a representation of him holding the wounded finger; but it is more probable, that the figure is in the act of devout meditation, as many fingers, with similar positions of the hands, occur. But quitting the fable for the fact, this excavation is, in beauty, inferior to none. In form it is unique, and in design elegant. The portico is light, and striking to the beholder. On the right hand, as you enter, is a fine cistern of water. Above the gateway (H,) which is richly sculptured on the outside, is a balcony, which seems well suited, if not intended, for a music gallery to the interior temple (I,) which has the appearance of an elegant chapel, with an arched roof, and is exactly in the style of a similar excavation at Canara on the island of Salsette, and another at Ekvera, near the top of Bhore Ghaut, first explored by Mr Wales the painter. At the upper end is the figure (1) above-mentioned. From the ceiling are projected stone ribs, following the curvature of the arch to the capitals of the pillars on each side, through the whole length of the excavation. Beside the grand aisle, or body of the excavation, there is a small passage formed by the row of pillars on each side round the altar; but it is dark and narrow. This singular form of a cave, wherever it has been met with, has conveyed the same impression of its being a place of congregation and adoration, rather than of residence or habitation, and has given rise to an idea, from the orbicular ceiling and the name and attitude of its inhabitant, that it may be meant to represent the Almighty, meditating the creation of the world, under the arch or canopy of unlimited space. It is necessary, however, to accompany this idea with an acknowledgment, that the similar caves of Ekvera and Canara are not inhabited by Bishurma,—they having only a very high altar, the top of which is circular, and situated as represented in the annexed drawing at the back of Bishurma.

Dimensions.

		Ft.	In.
Area, square, ...		49	0
Veranda below, in front, and each side, having 12 pillars, and two pilasters, ...	broad	14	0
	roof high	10	4
Doorway 4 feet broad × 8 feet 4 inches high; gallery above the door, ...	square	14	0
Length of the temple from the entrance to the opposite wall behind the altar, ...		79	0
Breadth of ditto from wall to wall, ...		43	5
Height of ditto from the centre of the arch to the floor, ...		35	0
N. B. The height between the pillars and the wall where the ceiling is flat, is		14	10
Breadth between the pillars and wall, ...		7	8
Circumference of pillars (two square, and 28 octagon ones,)		8	1

Altar at the end about 24 feet high.

Square inclosures.

Seringham seven inclosures.

3. The third kind of temples are those composed of square inclosures; the largest is that of Seringham, situated near Tritchinopoly. The pagoda is composed of seven square inclosures, one within another; each side of the outermost is a mile in length, making the whole four miles in circumference. The walls of each inclosure are 350 feet from those of the others; they are 25 feet high, and four feet thick. Each inclosure has four gateways, that is, one in the middle of each side, opposite the cardinal points. In the outward wall, the gateway which fronts the south is ornamented with pillars, several of the single stones 33 feet long, and five feet diameter; those of which the roof is composed are still larger. All the gateways are covered with figures emblematical of their divinities. In the innermost inclosures are the chapels. Into the last, which is 1024 feet square, and contains the sanctuary of Veeshnu, no European is willingly admitted; but during the wars

* Creator of the World, but allegorically artificer of Ram.

between the English and French, it was alternately occupied by each.

Chillambrum. The pagoda of Chillambrum, which consists of one square, only 1332 feet by 936, entered by a pyramid 122 feet high, has already been sufficiently described in the historical Part of this article.

Ahmed-Abad. The pagoda Ahmed-Abad in Guzerat, or pagoda of Santidus, consists of three courts surrounded with marble columns, and paved with marble. No person is admitted into the innermost court with their sandals on. All the porticos are covered with female figures of excellent workmanship; the inside of the roofs and walls are decorated with Mosaic and precious stones, (see *Tavernier* and *Thevenot's Travels.*) This pagoda was converted into a Turkish mosque by Aurenzebe.

Jumna-Mesgid. The Jumna-Mesgid is quadrangular, 140 paces by 120; round the inside of the inclosing wall runs a gallery, having its roof supported by 34 pillars. The temple itself stands upon 44 pillars, ranged in couples; the pavement is marble; in the middle of the front are three large gateways. On the sides are two gateways; each gate has a sort of pilasters: the minarets are Mahomedan.

Buswara. The pagoda of Baswara, or Bezoara, now a fort on the Vistnu river, is not inclosed by walls, but stands upon 52 lofty columns, with statues of Indian deities standing between them; it was placed in the midst of an oblong court, which was surrounded by a gallery, supported by 66 pillars. (See *Tavernier.*)

The cross. **Benares.** 4. The fourth kind are in the form of a cross. The most noted is that of Benares, in the city of Casi, on the banks of the Ganges, down to which there is a flight of steps. This, from the earliest period of history, has been devoted to Hindu religion and science. The form of the temple is that of a great cross, with a cupola in the centre, which, towards the top, takes a pyramidal form. At the extremity of each branch of the cross, which are of equal length, there is a tower with balconies, to which the access is on the outside. Within the temple, immediately under the central cupola, there is an altar, eight feet in length, and six in breadth, covered sometimes with tapestry, sometimes with cloth of gold and silver. Tavernier saw several idols, one, in particular, six feet high, having its neck decorated with a chain of precious stones; the head and neck only were visible; the body was covered with a robe. On the right of the altar was a golden figure, composed of an elephant, a horse and a mule; upon this the deity journeyed on his guardian care of mankind. In this pagoda was also an idol of black stone, or Sammena codom. Aurenzebe polluted this temple.

Mattra. Mattra, the Methora of Pliny, 18 miles from Agra, on the road to Delhi, is the birth-place of the beneficent god Chreeshna. The pagoda is constructed of the same stone as Delhi, and stands upon a very extensive octagonal platform of hewn stone. This platform is ascended by two flights of stone steps, which lead to the grand portal, composed of pillars with the usual sculptures. The pagoda is in the form of a cross, with a lofty cupola in the centre, and two others nearly similar on each side. The sanctuary is separated by a balustrade, behind which only priests are admitted. In the sanctuary is a square altar, 16 feet in height, covered with gold and silver brocade, and here stands the god Ram Ram; the head only is visible, and appears of black marble, with two large rubies for eyes; the body is covered with a robe of purple velvet.

Circular. Juggernaut. 5. Of those which are of a circular form, Sonnerat thinks that Juggernaut is the most ancient in India, and says that the Brahmins attribute it to the first king on the coast of Orissa, 4800 years. Its plan is a perfect circle, of immense size. Juggernaut is said to be only another name for the god Mahadeo, who is represented by the figure of a large bull, which projects out of the eastern side of the edifice: the image of Juggernaut stands in the centre of the building, upon an elevated altar, surrounded by an iron railing. Mr Hamilton describes the idol as being an irregular pyramidal black stone, and the temple deriving light only from 100 lamps. He compares the edifice to a great butt set on end. This place is the residence of the Arch-Brahmin of all India, and the sacred dominions are said to yield pasturage for 20,000 cows. See Buchanan's *Christian Researches.*

Temple of the Sun. Besides these, which are offered as specimens of the different forms of Hindu temples, there is one more which our general views of the matter require to be noticed. The Ayeen Akbery relates, that near to Juggernaut is the temple of the Sun, in constructing which, the whole revenue of the Orissa was, for 12 years, wholly expended; that the wall which surrounds the whole is 150 cubits high, and 19 cubits thick; that there are three entrances; at the eastern gate are two elephants, each with a man on his trunk; on the west are two figures of horsemen, completely armed; and over the northern gate, are two tygers sitting upon two dead elephants. In front of the gate is a pillar of black stone, of an octagonal form, 50 cubits high. After ascending nine flights of steps, there is an extensive inclosure, with a large cupola, constructed of stone, and decorated with sculptures of the sun and stars, surrounded by a border, composed of a variety of human figures, some kneeling, some prostrate with their faces on the earth, and some representing minstrels, also a number of imaginary animals. But of this splendid temple, so minutely described in the Ayeen Akbery, not a vestige is now to be found.

Sculptures.

Tanks for ablution. It may be observed, generally, that these temples, for the sake of ablution, are usually placed on the banks of the Ganges, Vistnu, or some sacred river; or where that is not the case, artificial tanks or reservoirs are constructed, generally of a quadrangular form, lined with freestone or marble, and having steps to descend into them. Crawford mentions several tanks from 300 to 400 feet in breadth. (Crawford's *Sketches*, vol. i. p. 106.) Some of these tanks cover 8 or 10 acres, have steps of masonry 50 or 60 feet long, are faced with brick-work, and plastered substantially and neatly. The corners of the tank are generally ornamented with round or octagonal pavilions. (*Oriental Sports*, vol. ii. p. 116.)

Birman empire. **Temples of Godama pyramidal.** In the Birman empire, which, for situation and various circumstances connected with its history, is one of the most interesting districts of the East, the temples of Godama are of a pyramidal form, of solid brick-work, placed upon an elevated terrace; and the base of the great pyramid is frequently encompassed by a double row of small ones, having its summit terminated by an umbrella made of iron bars into a sort of filigree work, and adorned with bells; many of these pyramids are from 300 to 500 feet high. In the larger temples, the umbrella, with at least the upper part, sometimes the whole, of the pyramid, is entirely gilded. Other temples, of similar shape, are hollow, and have images of Godama within them; but the images are more frequently placed in chapels, which encompass the pyramid. Dr Buchanan saw at Ava an image of one block of pure alabaster, of so large a size, that one of its fingers appeared about the length and thickness of a large man's thigh and leg. The whole statue must therefore have been above fifty feet high.

At one village, Colonel Symes saw 30 or 40 yards full

Numerous statuaries.

of statuaries, all employed in making images of the god Godama, and all in the same position, that is, sitting cross-legged upon a pedestal; the smallest exceeded the human stature. The price of this size was 100 tackals, or 12 or 13 pounds sterling. They work the marble with a chisel and mallet, and polish with three stones of different fineness; and, lastly, by rubbing with the hand, which gives a great degree of brightness and smoothness.

At Umapoora, were spires, turrets, and lofty obelisks. The fort is an exact square, with public granaries and storerooms, and a gilded temple at each angle, upwards of 100 feet high. In the centre of the front stands the royal palace, with a wide court in the front, beyond which is the council-hall, supported by eighty pillars, on eleven roods. The royal library is a brick building, raised on a terrace, and covered with a roof of a very compound structure; it consists of one square room, with an inclosed veranda or gallery round it. (See Colonel Syme's *Embassy to Ava*, 1795.)

With regard to the present practice of Hindu architecture, we learn, that in Benares, their holy city, situated on the north bank of the Ganges, 460 miles N. W. of Calcutta, the streets are so narrow as not to admit of two carriages to pass one another. The houses are built with large stones, accurately joined. Some of them are six stories high, with terraces on the summits; a band or string course, decorated with sculpture, tolerably well executed, serves to mark externally the division of each story. The windows are very small. The houses on the opposite side of the streets sometimes communicate by galleries. The number of houses built of stone and brick are reckoned at 12,000; those with mud walls 16,000. In this city there is a stupendous observatory, a great number of Hindu temples, and a spacious mosque, built by Aurenzebe, from the minarets of which, the whole city may be seen.

By the kindness of a gentleman, whose opportunities and disposition for accurate observation have qualified him to afford the most authentic information, we are enabled to give the following account of the modes pursued by the Hindoos in the construction of their dwelling-houses: "The houses of the opulent are substantially built of stone and brick, with lime mortar, generally terraced with small bricks, about four inches square, and one inch in thickness; the beams are laid about 12 feet apart, and the joints ten inches. The masons begin to form the terrace at one angle of the building, sitting upon a plank, which is supported on the brick-work as they proceed, until they finish at the angle opposite to that at which they commenced. They have no planks upon the beams or joists to support the work below; but as the middle of the terrace (generally about 18 feet wide) is from five to six inches higher than the sides, an arch is thereby formed and supported by the surrounding walls, which are 20 inches in thickness, and have a parapet placed upon them, both for ornament and adding to the security. Over this brick arch is laid a coat or layer of jelly or gravel, or broken bricks, about the size of a large pea, mixed with quicklime and jaggury water; this is beat down hard with small hand mallets. Over this first coat is laid a second, composed of rough lime mortar, which is scored across. The third and last coat is a fine chunam; and this, altogether, forms so strong and firm a body, that a whole terrace sometimes falls down entire and unbroken. Many houses are built with pointed roofs, covered with flat tyles, four inches square, and three-quarters of an inch in thickness; others have a slight coat of lime, with pantyles, which are seldom above seven inches by four; they are semicircular nearly. The houses of the middling class are usually built in a square, and covered with tyles, with a seat round the inside of the square, about three feet high, and three feet in width, protected by a viranda; it is here the inhabitants sit to receive their guests. There are no windows in the external walls, but to each house there is a small door, and frequently a window; the latter placed as high as the viranda will admit. In the open square there is generally a wall, with a water-course below the house for domestic purposes. The houses of the poor are miserable; a few bamboos stuck in the ground, in a circular form, are collected, bent, and tied at the top, so as to represent an egg with the end cut off. They are seldom ten feet diameter, with a hole about three feet high to creep in at; this is shut with a leaf, tied on a simple wicker frame. The towns are generally a long street, with others at right angles, but seldom built with much regularity; some are large, some small; some are thatched and others tyled. Those in the interior parts of the country are inferior to those near the sea-coast towns where Europeans are settled."

From the account of Colonel Syme's embassy to Ava, we learn, that in the Birman empire, in private houses, the use of brick and stone are prohibited, and they are therefore all constructed of wood. They are all raised from the ground by wooden posts or bamboos, according to the size of the building, and made tolerably convenient. The roofs are slightly covered, and at every door stands a long bamboo, with an iron hook at the end, to pull off the thatch, and another with an iron grating, to stifle the flame by pressure. Firemen constantly patrole the streets at night.

PERSIAN ARCHITECTURE.

General remarks.

The ancient architecture of this extensive, rich, and interesting country, must be considered chiefly as it regards their cities, palaces, and tombs; for, with the exception of the temple of Belus, and some other temples, their mythology did not admit of sacred edifices. They were in this respect the reverse of the Egyptians and Indians, who, as has just been seen, seem to have devoted much of their time and attention to constructing and decorating temples. The accounts of the ancient Persian cities and palaces which have reached us, being very general and indistinct, we can add but little to what has already been stated in the historical Part. It will therefore be by the means of Persepolis alone, that we shall be enabled to enter into any particular details, or produce engraved specimens of the ancient school of this country; fortunately, sufficient remains of this palace have been preserved to afford satisfactory information in regard to many of its leading features. Of the present style of architecture, in their principal cities, some specimens will also be produced.

Babylon and Nineveh.

Streets.

The ancient cities of Babylon and Nineveh seem to have been existing at one time, and are said to have been nearly of the same form and extent. All accounts agree that this extent was very great, and that they had many wide streets, crossing each other at right angles. But Babylon was repeatedly destroyed and restored. The descriptions of it were taken after it had been rebuilt upon an uncommonly magnificent scale, by Nebuchadnezzar; and the comparisons, having formerly been just, were afterwards transferred to the new city. But that great degree of regularity which is mentioned in the descriptions of Babylon, are not to be attributed to cities of slow and gradual growth; it is the result of conquest at an advanced state of society. The most incredible circumstances respecting these cities, are what relates to

Walls.

their walls. Those of Nineveh are said by Diodorus to have been 200 feet high, and of a breadth sufficient to admit three chariots abreast. Those of Babylon are said by Herodotus to have been 350 feet high, 80 feet thick, and 60 miles in circumference; Diodorus says, six chariots might pass abreast. Others remark, that they were 50 cubits high, after being in great part demolished in the reign of Darius Hystaspes;

Gates.

that there were 25 gates on each of the four sides, opposite the ends of as many streets; and that these streets were 150 feet in breadth.

Remarks.

It is conceivable, that walls of the height of the London monument might have, during the long existence of a rich empire, been raised to protect so great a city as Nineveh; but it requires a much greater stretch of thought to conceive them, as in the case of Babylon, to be raised to a height equal to that of the cross which terminates the dome and cupola of St Paul's cathedral in London. Yet when we recollect, that Nebuchadnezzar was intoxicated with conquest, in possession of unbounded power and riches, and ambitious of creating a metropolis for all Asia, upon a scale which should far surpass every city the world had seen, we shall hesitate in condemning as improbable even the descriptions of Herodotus.

Built of rick.

All these mighty works were built with bricks. It is probable that, being situated in rich plains, proper stones were not easily procured. The excavations from the protecting ditches on the outside of the walls, furnished clay for bricks, and they were laid in mortar of bitumen. They are the earliest specimen of cementitious building we know of, and was no doubt the result of working with bricks.

Persepolis.

Le Brun, after much elaborate discussion, concludes, that Persepolis was built by Darius and Xerxes; and Strabo says, that after the kings of Persia had ornamented the palace of Susa, they did the same to Persepolis and Parasgade. No traces of any city remains. The ruins are usually named the House of Darius, or Chilmenar, that is, the Forty Columns. (See Plate CLIII.)

PLATE LIII.

Travellers, probably misled by this, have said that there were only 40 columns: but Le Brun discovered the traces of 205. He found 19 standing in January 1705. He asserts that there is no appearance of any thing belonging to a temple; but that it certainly is the remains of the palace destroyed by Alexander.

The pa- ace.

He traced the façade 600 paces from north to south, and 300 from east to west.

Descrip- son.

The door-ways or entrances which remain, have a perfect resemblance to those which are between the great moles at the entrances into the Egyptian temples. (See Plates CLIII. and CLIV.)

PLATES LIII. and LIV.

They have tapering outlines; and the crowning member is a large cavetto, similarly fluted. The columns are of more slender proportions than the Egyptian, being about 13 diameters high; that is 72 feet high, and 17.7 diameter. Each has a moulded base, 4.3 high, and 24.5 in circumference. Their capitals occupy about one-fourth of the whole height of the column. The shaft does not diminish, and in this bears a resemblance to those at Tentyra. The capital at Tentyra, also, by having first four heads of Isis, with a sort of drapery, and above that an ornamented square member of considerable height, occupies a space much greater in proportion to the column, than the vase capitals. But the Persepolitan capital occupies a still greater proportion of the whole height.

emarks.

It is possible, as alleged by some historians, that these columns, and the numerous sculptures at Persepolis, have been executed after the time of Cambyses, by Egyptian workmen; or that the idea of constructing columns of this magnitude of stone, may have been suggested by those of the Thebaid. But the Persians, detesting the Egyptian mythology, and instead of temples, being engaged in constructing palaces, they adopted representations of the ornaments with which they had been accustomed to decorate the posts and walls of the public apartments at their splendid festivals. The Persepolitan capitals therefore convey the idea of rich silks and feathers having been tied round the upper part of tall wooden posts; and, as has just been shewn in the case of India, rich silks, feathers, and precious stones, have always been the materials with which eastern monarchs formed their most gorgeous decorations. By inspecting the Plate of Persian capitals it will be seen, that they exhibit distinct representations of the spirals of the volute, said to have been invented long after by the Ionian Greeks.

The appearance of the tall slender columns, and their not having been any fragments forming parts of a roof found amongst the ruins, has led some to conjecture, that Susa being the winter palace, Persepolis was a summer residence only, with a temporary covering. The roof may, perhaps, have been slightly constructed of wood; and the interior covering and decorations being silks, &c. may have been occasionally fixed up and removed as the court was present or absent; but economy never having been attributed to Persian princes, even this circumstance does not wear an air of great probability; and much less that roofs and partition-walls were alternately fixed up and removed. Respecting the nature of the partition-walls, and the forms and dimensions of the apartments, we are left quite in the dark.

Sculptures.

The sculptures upon the terraces and sides of the stairs are very numerous. Le Brun considers them triumphal processions; and from the circumstances connected with them, endeavours to determine the era of their execution. He observes, that the dress and arms are partly Persian and part Median. The Persians offered horses to the sun, and oxen to the moon, as shewn in the sculptures. In the processions there is the tiara worn by the nobles in the time of Cyrus, when it is known that the great lords did assist. The umbrella, which is so frequently represented, was in use amongst the Persians; the long robes with foldings are a Median dress. The offerings before the altar, as exhibited, were made by Cyrus, Cambyses, and other princes of the royal blood.

Tombs of kings.

Although the ancient tombs of the kings belong properly to the word SEPULCHRE, where the subject will be treated generally, yet in this instance, forming, as they do, one of the most striking features of Persian architecture, we cannot, amongst the scanty remains of that school, avoid describing, and also giving an engraved representation of the front or entrance to the principal one, where it is said the body of Darius was deposited. (See Plate CLIII.)

Descrip- tion.

PLATE CLIII.

To obtain a perpendicular front or entrance into the tomb, a recess is cut in the rock for about 60 paces in depth. The front so obtained is about 70 feet in breadth in the base, 40 in the decorated part, and about 70 feet in height. By consulting the Plate, it will be found to bear a striking resemblance to the entrance of the cave of Biskurma at Ellora. The lower columns which support the sculptured gallery have capitals composed of oxens heads and necks projecting from the top of the column. Upon the columns are represented four great beams as an architrave; upon this runs a cornice, which has 2 feet 9 inches projection; and upon this is a dado, where 18 lions are sculptured, nine looking from each side towards a small vase, which stands in the middle of the length. Above the lions are two ranges of human figures, fourteen in number, and nearly as large as life; they are each holding up both hands, as if to support the entablature. At each extremity of these there is a sort of column, crowned with the head of a strange animal. Above all these, upon three steps, is the figure of a king with something in his right hand, the form of which cannot be distinctly made out; but he holds a bow in his left hand. Before him is an altar, with a flame rising from it; and it is said that the figure of the sun was behind the king. Above the altar is a small figure, too indistinct to be made out. At right angles with the line of front, in the returning face of the rock, on both sides of the front area, there are niches with statues in them. Le Brun entered a tomb to the south of this; the entry had only two feet of height, and the vault was 46 feet broad and 20 deep. Two hundred and fifteen paces south of the edifice, there is a column now standing upon its base; and near it are the bases of eight others, at seven and eight paces distant from each other: the height of the base is 9 feet 6 inches. At the sides of the two bases towards the south, are two fragments of camels, which may have been upon the columns. Six hundred and fifty paces to the north, is another portico, not inferior to that which has been described. Le Brun found about 1300 figures of men and animals sculptured on the tombs; some of the men were from 7 feet 5 inches to 10 feet 7 inches high, some had parasols or umbrellas over them, and many were armed with lances, and combating lions.

Thirteen hundred figures.

Such are the splendid ruins of Persepolis. They bear incontrovertible evidence of antiquity; and although in some things they resemble Egyptian, and in others Indian edifices, they, especially in the palace, possess leading features sufficiently distinct to entitle them to be considered as a separate school. Yet as being, amongst numerous palaces, the only vestiges of lofty stone columns and numerous sculptures, and being traced immediately subsequent to the Egyptian expedition under Cambyses, they afford strong grounds for believing that Thebaid influence, by example, or workmen, or both, led to these works, so unlike what had formerly been practised in Persia. That the style was not spread over the empire, may be accounted for, from its immediate subjugation by the Greeks.

Modern practice.

With regard to the practice of Persian architecture in modern times, their sacred edifices have an uniform character of Turkish mosques; some in monastic quadrangles, with flat domes over each separate apartment, and others with lofty minarets, or tall pillars. The churches of the Arminian Christians are rectangular, with a circular recess on each side, and four great pillars in the middle of the cell. That of Echmiazin, the plan and elevation of which is given by Sir John Chardin, measures 102 feet by 88, exclusive of the circular recesses on each side; the pilasters at each of these recesses, and in the four piers occupying the middle of the cell, are said to be of stone, 72 feet in height.

"In architecture, as well as in sculpture," says Mr Kinneir, the most recent traveller in Persia, "the ancient Persians would appear to have surpassed their descendants. Of this we have many noble specimens in the ruins of Persepolis, Shuster, the hall of Kungaver, and the remains of the palace of Chosroes Parviz, at Ctesiphon. The chief ornaments of the modern buildings, are the domes and minarets; and considering the materials with which they are built, many of the colleges and mosques are large and magnificent structures. The grand mosque of Sultaun Khodabunda, in the plain of Sultanea, is particularly handsome, and many of the public edifices at Shirauz and Ispahan, are well worthy of attention.

The general outlines of all the cities in Persia are the same. They are surrounded by a mud, and sometimes by a brick wall, flanked at regular distances with round or square towers. The streets are narrow and dirty, having a gutter running through the centre, and the houses, which are low, flat roofed, and built of brick or mud, have each a small court, surrounded by a high wall. They have seldom or never any windows to the street; and that part of the sitting rooms which fronts the court is entirely open, with a large curtain to let down when the rooms are not in use. The palaces of the nobility, although mean in their exterior appearance, are both convenient and elegant within. They are divided into several courts, in the most retired of which is the haram, or apartments of the women. The centre court is usually square, divided into parterres of flowers, with a jet d'eau continually playing before the window of the *dewan kana*, or public hall. The walls and ceilings of this hall, are adorned with a profusion of paintings, and inlaid with looking glasses; the floor is covered with carpets and *numuds;* and one entire side of the room is taken up with large sash windows of painted glass. The apartments of the haram are frequently fitted up with great taste and magnificence, but the sleeping rooms allotted to strangers are, in general, small. The Bazars, or market places, in some cities, particularly those of Lar and Shirauz, may be accounted handsome buildings, but the mosques, minarets and colleges are the chief ornaments of the Persian cities." See Kinneir's *Geographical Memoir of Persia*, p. 52. Lond. 1813.

Inn.

"The royal inn, without the city of Cashan," says Sir John Chardin, "joining to the gate that looks toward the east, is the finest in all Persia. It is four-square, every front withinside being two hundred geometrical paces; and two stories, with an antichamber or hollowness below, that runs all along the length of the two fronts, raised about the height of a man above the court, and four inches below the level of the chamber. It is eight feet deep, paved with white marble, almost as transparent as porphyry. The stories on the sides contain fifteen chambers of the same figure; the two others had but ten, with a large one in the middle, having five chambers. The other apartments consisted of one chamber, fifteen feet long and ten broad, high and vaulted, with a chimney in the middle, and a square portico before, ten feet wide, covered with a half duomo, with a contrivance for a chimney on each side, which was for the servants to lodge in. The second story was contrived like that below, with a baluster four feet high, that let in the light, and ran round the structure. In the geometrical part of the draught, you may perceive a hexagonal in the midst of the entrance, every front of which is a large shop, where are to be sold all manner of belly-timber, wood, and forage. The entrance is under a high and magnificent portal, adorned with Mosaic work, like all the rest of the building; and upon the sides runs a portico, where you may lie in the day-time as conveniently and as pleasantly, as in the inn itself. The fountain in the middle of the court is raised above five feet; and the brims of it are four feet broad, for the convenience of those that will say their prayers after they have performed their purifications.

"The hinder part of the caravansary consists of very large stables, with places for servants and luggage, built almost according to the same symmetry as the apartments already mentioned, at least as to the form and bigness of storehouses, and lodgings for the poor, and the country people that bring their goods to sell; and the large gardens that lie behind this lovely palace of a caravansary, no less famous for its founder, Abas the Great, who caused this sumptuous structure to be erected. Near adjoining to it stands the Palace Royal; and over against it, another designed for the lodging of ambassadors. Both the one and the other, with very large gardens behind them, were built at the charges of that renowned monarch. Besides that, there is in the middle a void space for their carousals, and other exercises on horseback."—*Sir John Chardin*, p. 412, 413. London edit. 1686. See CARAVANSERA.

CHINESE ARCHITECTURE.

Chinese architecture.

General remarks.

Before leaving Asia, we must advert to the architecture of a people, singular in many respects, placed at the eastern extremity of the Old World, and far removed from the restless activity and ambition of Arabs and Europeans. The extensive and populous empire of China has long remained stationary, with regard to customs, arts, and sciences. The practice of its architecture has been too long established, and our intercourse with the country too recent, to enable us to trace any account of its origin; but the general principles of its construction have evidently been taken from the tent. Its cities are only large encampments. In each individual building, the outlines of its form, its numerous small parts, its slender columns and slight covering, are all measured and modelled by the tent.

During the last two centuries, China has, however, been frequently visited by men of talents and observation, who, in spite of the jealousy of its government, and the prejudices of its inhabitants, have acquired and communicated minute and satisfactory accounts of the practice of its architecture. The authors from whom we shall chiefly select information, are, Duhalde, Le Compte, Chambers, and Barrow.

Sir William Chambers.

From Sir William Chambers we learn, that there are temples of various dimensions and forms. 1. Some very small, consisting of one apartment only. 2. Having a court, surrounded by a gallery leading to a ting (or large apartment) containing idols. 3. Composed of several courts, encircled by galleries, wherein Bonzes have their cells, and the idols their halls; these last are more properly convents. 4. The lofty tower, or Taa.—All these are known by the name of Pagoda.

Pagoda of Ho-nang.

The first object in the pagoda of Ho-nang, in the south suburb of Conan, is an extensive court, where an avenue formed by three rows of trees conducts to a vestibule, which is open, and ascended by steps. This is succeeded by a second vestibule, containing four colossal statues, composed of a sort of stucco representing marble; they are seated, and have in their hands various symbols. This last vestibule leads to a large court, encompassed by colonnades and cells for the Bonzes, and having in the middle four pavilions or temples, two stories high, filled with idols, before which the Bonzes perform their religious rites. In the corners of the court are also four pavilions, where the superior Bonzes reside. Behind the colonnades, between the cells, are four halls which contain idols. Near the middle of the length of this large court, two smaller courts surrounded with buildings are projected, of which those on one side serve for kitchens and refectories, and those on the other for hospitals. The forms of the pavilions are various. The cells of the Bonzes are very small, and have no light except what is admitted by the door. The pavilions and their pillars, as well as those of the colonnades, are of wood, with marble bases. All the buildings are covered with tiles of coarse porcelain, painted green and varnished.

This disposition common.

This disposition is common to all temples of this sort; and by omitting the pavilions in the middle of the great court, it bears a near resemblance to most Chinese edifices of importance. The palaces of the emperor, princes of the blood, mandarins, and Kong-Quaen, or colleges of letters, are all nearly of the same form.

Lofty towers or Taas.

To the lofty *towers* the Chinese give the name of *taas*; but they are known to Europeans by the name of *pagodas*. Duhalde says, they are so common, as, in some provinces, to be met with in every city and large town, and even in the villages. The most celebrated are the Porcelaine Tower at Nang-king, and that at Tong-Tschang-Fou. Of the former, from Duhalde (Vol. I. p. 129,) we learn, that this tower, unquestionably the tallest and most elegant in China, has eight faces, each 15 feet in breadth, and is 20 Chinese toises (200 feet French) in height. It is divided into nine stories, by floorings within, and cornices without, which support small roofs covered with glazed tiles of a green colour. From p. 200 of the same volume, we learn also, that the tower at Tong-Tschang-Fou consists of eight stories; that its outside is of porcelain, decorated with various figures; that the interior is lined with highly polished marbles of different colours; that a staircase, formed in the thickness of the wall, leads to the several stories; and that at each story there is, on the outside, a marble gallery quite round the tower, protected by lattices of gilt iron. At each corner of these galleries small bells are suspended. These octagonal towers diminish as they ascend, as well in the height as in the breadth of each story; and, in general, the apex of the edifice supports a long pole, encompassed by a number of iron rings, and secured by eight chains fastened at one end to the top of the pole, and at the other end to the angles of the upper roof. In some of these towers, the stairs are in the inside in the middle of octagonal chambers, and the cornices consist of a fillet and large cavetto, decorated with representations of the scales of fishes, an ornament very common in China.

Porcelain tower of Nang-king.

Tong-Tschang-Fou.

Plate CLV.

In Plate CLV. is given an elevation of a Taa or pagoda of this sort, which is situated upon the shore of Ta-ho (great river,) between Canton and Hoang-Pour.

Imperial palace.

Respecting the *imperial palace*, Duhalde furnishes a description given by a missionary who was admitted into the presence of the emperor in his own apartments, of which the following is the substance: The southern gate never being opened but for the emperor, he entered by a western gate into a court which lay to the south of the palace. Its form was a double square; at each extremity was an edifice of an oblong form, two stories high; the lower story having three openings like the gates of a city, the court from north to south was more than 200 geometrical paces; it was paved with coarse bricks laid on edge, and intersected by walks paved with large flat stones. In passing from this to a second court, a canal lying east and west was crossed by one of six bridges of white marble, erected near its middle, and facing four vaulted gateways, which are surmounted by a large platform or turret, and upwards of 20 geometrical paces in breadth. At the entrance of the bridge leading to the middle gateway were two large round columns of white marble, placed on pedestals, inclosed by a balustrade of the same material, and having two lions, seven or eight feet high, standing upon plinths, and apparently all of one block. This second court is scarcely 100 geometrical paces in length, and about half this in breadth. At the entrance of the court are other two columns of white marble, decorated with dragons in relief, and two small wings placed a little below a flat and very large capital. From this there was a passage into a third court twice the length of the second, and a little wider, by five gateways similar to the former. The gates are very thick, and covered with iron plates, which are fastened by means of rows of copper nails, with heads larger than a man's fist. All these buildings are elevated on a soclé or plinth about the height of a man, built with pieces of reddish-grey marble badly polished. All the courts are surrounded by low buildings, covered with yellow tiles. At the termination of the third court was an edifice of moderate length, flanked with two pavilions, each two stories high, encompassed by galleries. These are connected by wings terminated by two pavilions similar to the former. The lower story of this edifice is raised on a platform of brick about 35 feet high, crowned with a parapet with small inclosures. The base of the platform, to within six feet of the lower story, is built with marble; its lowest part is pierced with vaulted apertures, shut by gates similar to those already described, only that the brass nails and fastenings are gilt. Having passed these three courts, a fourth, of about 80 geometrical paces square, is entered: this is encompassed by galleries occasionally intercepted by small open saloons, opposite to which are staircases with balustrades of white marble. This court is intersected by a small canal, lined with white marble, and having marble balusters along its edges: there are four or five bridges over this canal, each of a single arch of white marble, decorated with mouldings and bas reliefs. At the extremity of the court is a magnificent saloon, approached by three staircases similar to those already described. In a fifth court, of dimensions and shape similar to the last, is a square perron of three stories, and at each story encompassed by a white marble balustrade, the height is about 18 feet: It is built on a soclé or plinth of coarser marble, about six feet in height; the ascent is by three staircases, the middle one of which is the most considerable. Eight bronze vases, about seven feet high, adorn the summit of this perron. At its base, near the principal staircase, are two enormous figures of lions in bronze; this edifice stands opposite a magnificent hall. From hence passed through two other courts differing little from the last; and from thence through a door on the right into an eighth court, about 200 paces in length; at the end of this, a large open hall on the left; and from thence into a ninth court, rather smaller than the last; at the extremity of this, there was an edifice of an oblong form, of two stories high, like the former,—a sort of causeway raised six or seven feet, paved with marble, and protected by a balustrade of the same material, led to the edifice which contained the emperor's apartment.

Sir W. Chambers states, that the Chinese do not distinguish their places of worship by any particular form. Thus, the *Ting* or *Tong* enters into all sorts of buildings, in almost all temples, all palaces, over gates of cities, and in every place where a display of magnificence is intended. In temples, three sorts are met with, and a fourth in most gardens.

Ting of pagoda of Cochin-China.

The Ting of the pagoda of Cochin China is raised on a basement, and approached by three flights of steps; the plan is square, encompassed by 24 columns, which support a roof which has a balustrade to protect a gallery quite round the building. The upper story is of the same form and dimensions, having dragons at the angles of its roof; the breadth, including the columns, is equal to the height; the body of the building occupies two thirds of this space; the height of the order is two thirds of the breadth of the body; the height of the second story is two-thirds of the first; the columns are nine diameters high, the bases two diameters; the beams and consols, which occupy the place of a capital, are one diameter; the entrelas, or frieze, under the first roof, is also one diameter in height.

Second sort of Ting.

The second sort of Ting differs only from the former by its upper story having neither gallery nor balustrade, and in the covering of the colonnade, being brought close against the wall.

Third sort.

In the third sort, the lower story is also nearly the same as in the first; but in the upper story, on two sides, there are advanced columns which form galleries. In this Ting the lower columns are eight diameters high, the base one. All the columns, with the exception of those at the corners, have eight consols or brackets, which form a sort of capitáls; the columns of the second order have their diameters about $\frac{4}{5}$ of the lower, and are about $6\frac{1}{3}$ diameters high. They have no bases. Under the roof is an entrelas composed of squares and circles; the corners of the roof are ornamented with dragons and foliage, the top with two dolphins at the ends, and a flower like a tulip in the middle.

In some instances, the building is closed in front by moveable doors, and has five advanced columns; in other cases, the building is quite open in front, with four columns to support the roof. In two instances in the court of one of the pagodas at Canton, there are two pavilions covering two iron vases, used in the sacrifices of gilt paper to their idols on festival days; they are both octagonal, and have each eight columns supporting a roof, upon which there is a lantern and other ornaments. One of these pavilions is a little elevated, and surrounded by steps; the columns stand on bases whose profile differs little from that of the attic; a frieze, with inscriptions in large Chinese characters, goes round under the roof; the lantern, which is octagonal, has a top in the form of a semi-inverse, finished with a small globe surrounded by flowers. The other pavilion is raised on a soclé or plinth, and inclosed by an entrelas of artificial stone, made of a species of potter's clay, cast in wooden moulds. The pieces are fitted with so much ingenuity, that the joints can scarcely be discerned; the columns are without bases, and under the first roof is an ornament of interwoven lozenges. The lantern has eight small columns without bases or capitals, which support a conical covering, decorated with a dolphin over each column: The apex of the building consists of a pierced ball, with a flower upon it.

Fourth sort.

The fourth sort of Ting, found in gardens, consists of twelve columns. The one in the middle of a small lake at Canton, stands on a basement, and is encompassed by a balustrade; the bases of the twelve columns resemble the Tuscan; the covering which rests upon the columns is crowned with a lantern; the heads of the shafts of the columns are pierced with the beams which support the roof, and their extremities are decorated with small grotesque heads and bells; a frieze, ornamented with an entrelas, runs immediately under the roof. Another pavilion had ten columns, with a roof and lantern in form of a cone, and terminated by a ball. In Plate CLV. will be found elevations of two of these

Plate CLV.

tings or temples, which stand in the court of one of the pagodas in the west suburb of Canton.

Houses of the Chinese.

In *Chinese houses*, the distribution is precisely uniform. Those of the merchants at Canton are all near the side of the river; they are narrow and very long: in other respects, they differ not as to interior distributions from the general scheme; the ground-floor is traversed in its length by a wide passage, which extends from the street down the middle of the habitation to the river; the apartments are on either side, and consist each of a saloon for receiving visitors, and a small bed-chamber, to which is sometimes added a closet or study; in front of each apartment is a court, at the extremity of which there is generally a fish-pond or cistern, with an artificial rock in the middle, covered with bamboos and other aquatic plants; the sides of the courts are usually decorated with flower-pots, or with blossoming shrubs, vines, or bamboos formed into arbours. It is common to have a large porcelain vase on a pedestal in the centre, filled with the flowers called lien-hoa.

Decorations.

The great room or saloon is generally from 18 to 20 feet in length, and about 20 feet in width. The side which is next the court is open, and provided with a screen of canes, which is occasionally let down. The pavement is composed of squares of stone or marble of various colours. The walls are covered with mats to about four feet from the ground. The upper part is covered with white, or crimson, or gilt paper. Instead of pictures, as in Europe, the Chinese hang up large pieces of satin or paper in frames, and painted to imitate marble or bamboo, whereon are written, in characters of azure blue, moral distiches and proverbs, extracted from the works of Chinese philosophers. Besides these, some persons have certain large characters, traced by a masterly hand in Indian ink on glazed white paper. This ornament is in high estimation. The farther end of the saloon consists of folding-doors, the lower parts of which are latticed, and covered with painted gauze to admit light into the bed-chamber. The doors, which are of wood, are neatly executed, ornamented with a variety of characters and figures, and sometimes highly varnished, and painted red, blue, yellow, &c. The doors are left open during the night to admit fresh air. The chamber is very small, and is only furnished with the bed, and some varnished trunks for holding apparel. The beds are sometimes of greater magnificence. The bedsteads, which resemble those of Europe, are made of carved rosewood, or of lacquered work. At the side of the chamber is a passage leading to the closet, inclosed by walls, and lighted by a window. The walls are decorated like those of the saloon, with moral sentences, &c. The furniture consists of elbow chairs, sophas, tables, shelves, and books. On a table near the window are pencils for writing and drawing, and instruments used by the Chinese in calculations.

Besides these apartments, there is on the ground floor the dining-room, the kitchen, servants' room, bath, privy, and counting-house. Towards the street is the shop.

The leon, or upper story, consists of large halls, which occupy the whole breadth of the buildings. These are occasionally converted into chambers for visitors. This is accomplished by means of a number of pieces of framed wainscotting two or three feet in width, and ten or twelve feet long. With these, in the course of a few hours, the space is divided into as many small rooms as the circumstances require. Some of the partitioning pieces are cut down to within four feet of the floor, and the apertures filled up with very thin oyster shells, being sufficient to admit light into the apartments. Of this sort of shell all the windows of the Chinese houses are constructed.

One of the large halls, nearest the entrance, contains the image and altar of the household deity, placed so as to be seen by every person in entering. The remainder of the upper story is divided into apartments for the family; and over the shops into rooms for the shopkeepers. The façades next the street, are either quite plain or occupied by shops; there is no other opening but the door, and that is screened by a mat to prevent passengers looking in. From the river the façades, consisting of pillars and galleries, have an airy and pleasant appearance.

Building Materials.

Their building materials are chiefly bricks and wood; the former are either merely dried in the sun, or baked in an oven or kiln. The walls are usually about 18 inches thick. The bricks, which are about the size of those in England, are worked in the following manner: Three or four courses next the foundation, are laid quite solid through the breadth of the wall. Upon these, the next course is laid header and stretcher alternately in both faces of the wall. The headers being laid opposite each other, meet in the middle of the wall, and there is a void space left between them equal to the length of the stretchers, and nearly of the same breadth. The succeeding course is laid stretchers only through the whole breadth of the wall, by which the joints of the cross bricks or headers in the course beneath are covered with a whole brick. This mode saves time and expence. The tiles for covering the roofs are either flat or semi-cylindrical, the latter being laid upon the joints of the former. The Chinese always leave the timbers of the interior of the ceiling or roof exposed; they are sometimes made of costly wood, and sometimes inlaid with ivory, copper, or mother-of-pearl.

Columns.

The columns used to support the roofs are usually of wood, upon stone or marble bases. They are without capitals, the ends of the beams being morticed through the heads of the shafts. The height varies from 8 to 12 diameters; the diminution is gradual from the bottom to the top; the bottom of the shaft terminates with an ovolo; the bases have a diversity of profiles. 1. In the colonnade to the pagoda of Cochinchina, the columns are nine, and the bases one diameter in height. 2. In one of the temples of the same pagoda, the columns are nine, and the bases are two diameters in height. 3. In the colonnade of the great court of the pagoda of Honang, the height of the columns is nine diameters, and that of the bases one. The projecting ends of the beams at the top are decorated with monstrous heads terminating in foliage, and the consols which support them issue from the mouths of grotesque masks, carved in bas relief upon the columns. 4. In a small pagoda, in the eastern suburb of Canton, the columns are eight diameters and a half high, and the bases only three quarters of a diameter; the ends of the beams are carved, to represent dragons heads, and all the timber of the roof is ornamented with inlaid work of copper, ebony, ivory, and mother-of-pearl, representing monsters, foliage, &c. 5. The column most usually met with in Chinese houses, is from eight to twelve diameters, and sometimes more; and the base from one half to two-thirds of a diameter. The profile is like the Tuscan of Palladio. 6. In a small pagoda, in the street of the European factories, the columns are of stone, and of an octagonal figure. Their height is eight diameters, of a circumscribing circle, and they have no diminution. The bases in the profile resemble the attic. Their height is equal to twice the breadth of one of the sides of the column. This kind of column, with some trifling shades of variation, is to be met with in almost all the pagodas.

Le Compte.

City of Pekin.

We have hitherto proceeded upon the authorities of Duhalde and Chambers. We shall now give some particulars from Louis le Compte, given in his *Nouveaux Memoires*. His description of the imperial palace and pagodas, corresponds nearly with those already given. They are too general to afford any further satisfactory information. Respecting the city of Pekin, he states that the principal streets extend in a direct line one league between the gates, and that they are 120 feet in width: that each shop-keeper puts out, on a pedestal before his house, a plank, 20 or 25 feet in height, painted, highly varnished, and having a list of the articles he sells: that these, on each side of the streets, at equal distances, have the appearance of scenes in a theatre. Respecting the city gates, he represents them as consisting of two large separate square buildings, connected by two very thick walls, so that the space enclosed may contain about 500 men in battle order. The first building, which has the appearance of a fortress, has no direct passage through it; it is entered at the side wall, by a gate proportional to the rest. When turning to the right, a second tower is met with, which commands the city, and has a gateway like the former; but it is so long, as to become dark towards the middle. In approaching Pekin, these immense gateways have a striking effect. The arches are built with marble, and the rest with large bricks, laid in excellent mortar. The walls are so high, as to conceal the city. They are so thick, that centinels on horseback are placed upon them. At every bow-shot distance they are fortified with towers. The ditch is broad and deep, but dry.

Triumphal arches.

Of *triumphal arches*, which are very common in China, he states, that they consist of three arches, the middle one being the highest. The four columns which support them are sometimes round, but more frequently square. They have no bases, nor any capitals; but the shaft is fastened into the architrave. The frieze is very high in proportion to the rest; it is decorated with inscriptions, and beautiful figures; with knots wrought one loop within another, and with flowers and birds—all in very bold relief. Instead of cornices, they have before and behind, large flat marble stones, like pent-houses.

Mr Barrow.

Houses and mud-walls, all mean.

The foregoing accounts and description, though we have no reason to question their accuracy, are yet in so uniform a tone of admiration, as to render it evident, that the favourable features only are exhibited. In order, therefore, to chasten, and perhaps to render the picture more perfect, we shall present the reader with some descriptions from an equally accurate and more recent visitor, Mr Barrow. Sailing up the river Pei-hoo towards Pekin, he observes, "there are few trees, except near villages, which are of mean appearance; the houses generally consisting of mud-walls, one story high, and thatched with straw or rushes. Here and there a solitary cottage intervened. Nothing bore any resemblance to the residence of a gentleman, or that could be called a comfortable farm-house; and although villages were numerous, no assemblage of hovels were perceived, that properly could be classed under the name of a town, except that of Lee-koo, near the mouth of the river, and Ta-koo, a few miles higher, until we proceeded to the distance of about ninety miles, when we entered the suburbs of the large city of Tien-sing, stretching, like London on the Thames, for several miles along each side of the river Pie hoo; but neither the buildings nor the river would bear any comparison, even with those parts about Redriffe or Wapping. Every thing, in fact, that we had hitherto seen wore an air of poverty and meanness." See p. 70, 71.

City of Pekin.

Palace.

Again, "The great road to the capital lies across an open country, which appeared to be sandy and ill cultivated; and the few houses on each side were of mean appearance, being commonly built with mud or half burnt bricks, up to the very gates of Pekin. This city is surrounded by a brick wall, rather less than thirty feet high, but extending round a circumference of nearly fourteen English miles. The buildings within are all so low, as to be completely hidden by the wall. They are all constructed on the model of a tent, being supported by slight wooden pillars, and concealed by a dead brick wall to the street. Their roofs alone appear above this enclosure; and, being arranged in straight lines throughout the whole city, give it very much the appearance of a vast encampment. With the exception of four great streets, which lead to the gates, the rest of the city consists of very narrow lanes, and every part entirely without pavement, and filled with sand and dust. There are no aqueducts; and the well water is, for the most part, intolerably nauseous. There are no drains. There are very few buildings which rise above the level of ordinary dwellings, excepting the rice magazines, at the angles of the walls, and a conical temple or two." And again, "The very dwelling of the emperor, and the grand hall in which he gives audience, when divested of the gilding and gaudy colours with which they are daubed, are little superior, and much less solid, than the barns of a substantial English farmer. The principal hall of audience at Yuen-mi-yuen stood upon a platform of granite, raised about four feet above the level of the court. A row of large wooden columns, surrounding the building, supported the projecting roof; and a second row within the first, and corresponding with it. The interstices between the columns being filled with brick-work to the height of four feet, the space above this was a sort of lattice work, covered over with large sheets of oiled paper, and capable of being entirely thrown open on public occasions. The wooden columns had no capitals; and the only architrave was the horizontal beam that supported the rafters of the roof:" (See p. 124.) Again, "The grounds of Yuen-mi-yuen comprehends a circumference of ten English miles, well laid out, but far short of the description by Sir W. Chambers. The buildings are all slight, detached and irregular, and the greater part of those, included within the precincts of the palace, are mere hovels, or very mean cottages."

Stone and clay floors.

Furniture scanty and mean.

With regard to the accommodation of the first officers, he states, "the stone or clay floors are sometimes, indeed, covered with a carpet of English broad cloth, and the walls papered; but they have no glass in the windows; no stoves, fire-places, or fire-grates in the rooms; no sofa, bureaux, chandelier, looking-glasses, book-cases, prints, or paintings. They have neither curtains nor sheets to their beds. A bench of wood, or platform of brick-work, is raised in an alcove, on which are mats or stuffed mattresses, hard pillows or cushions, according to the season of the year. Instead of doors, they have usually screens made of fibres of bamboo. (See p. 194.) There is not in the whole empire a statue, a hewn pillar, or a column, that deserves to be mentioned."

Earl Macartney's embassy.

By the introduction to the account of Earl Macartney's embassy, we are informed, "that in Nan-king, in the province of Kiang-nan, though the streets are narrower than those of Pekin, yet they are well paved, and are bordered in some places with a variety of stones curiously inlaid. The gates of the city and the temples have a beautiful appearance; but the most striking edifice is the famous porcelain tower, which is an octagon building, nine stories, or 200 feet high, and 40 in diameter. A winding staircase leads to the top, from whence there is a noble prospect of the surrounding country. On each story is a room, adorned with paintings and other ornaments; but that which is the most beautiful part of this building is the cupola, which rises from the uppermost story, and is supported by a mast fixed in the floor of the eighth story, round which a large iron hoop winds in a spiral direction, giving to the whole the semblance of a hollow cone rising in the air, having on the top a massive golden ball. From each angular projection a bell is suspended by chains or wires, which produces a tinkling sound by every vibration of the wind. This magnificent structure takes its name from the variegated tiles with which it is covered. The Chinese pretend, that it hath stood 700 years, being erected by the Tartars to celebrate their conquest of this country; but others are of opinion, that it was built by the Emperor Yong-lo, and consequently that it is about 400 years old." Pages 9. and 10. of Introduction.

Temple of Fo.

" In the province of Fo-kien is a famous port called Hiamen, or Emouy. Here is a celebrated temple dedicated to Fo. It stands on a plain by the sea coast, and at the foot of a high mountain. The front of this building is 180 feet in length, and the gate is ornamented with figures in relief. Immediately within the entrance is a large portico, having an altar in the middle, on which is a gigantic figure of Fo, made of brass, gilt, sitting cross-legged. At the corners of this portico are four other statues in a sitting form, 18 feet high, each of which is formed of one entire stone. One of them holds a serpent, which is twisted in different folds round his body; another has a bow and quiver; the third has a battle-axe; and the fourth a musical instrument, resembling a guitar. Next to this portico is a square outer court, paved with stones of a grey colour, the least of which is 10 feet long, and 4 broad. There is a pavilion on each side of this court, with a dome at the top, which communicate with each other by a gallery. In one of these pavilions is a bell 10 feet in diameter; in the other is an enormous drum, with which the Bonzes proclaim the new and full moon. The Chinese bells are struck on the outside with wooden hammers. The two other pavilions are appropriated to the use of the Bonzes, who are obliged to entertain all travellers that come hither.

" In the middle of this court is a tower, round which winds a stone staircase, that leads to a temple, the dome of which is adorned with Mosaic work, and the walls with stone figures in relief, of animals and monsters. The roof is supported by pillars of varnished wood. The pavement is composed of shells so placed, as to represent birds, insects, flowers," &c.

" In this temple is an altar, on which incense is always burning, and the lamps are always lighted. At one end of the altar is an urn of brass, which emits a mournful sound on being struck; and opposite to it is a wooden machine of an oval form and hollow; and both are designed to accompany the voices of the Bonzes, in celebrating the praises of their idol. This deity is called Poussa, whose image stands on the altar, holding an infant in his arms; several inferior deities are ranged round him in respectful attitudes. On the wall are hieroglyphical characters in praise of the idol; and among others is a painting in fresco, representing a burning lake, in which several persons appear to be swimming, some borne by monsters, and others guarded by dragons and winged serpents. Out of the lake rises a rock, on which sits the god, holding a child, who seems to call to the men in the lake, who are prevented from ascending the rock by an old man, having hanging ears and horns on his head, and who keeps them off by a large club. The Bonzes are themselves ignorant of the meaning of this piece.

A god holding a child.

" Leaving the tower, we cross the court into a gallery, containing 24 statues of Chinese philosophers; and at the end is a dining hall for the Bonzes. After passing through a large apartment we enter the temple of Fo, which is decorated with vases, filled with artificial flowers; but the idol is veiled by a deep curtain of black gauze. On the declivity of the mountain are several gardens; and numerous pleasant grottos are cut out in the rock." Pp. 20, 21, and 22, of Introduction.

Inn near Pekin.

In the further account of the embassy, we are informed, " they stopped to breakfast at a village near Pekin. The inn in which they were refreshed was not like those in England. It had neither elegance or ornament; but the rooms, though small, were neat and cool. All kinds of refreshments were produced. The party were anxious to discover the capital; but no seats or villas announced its appearance. At last they came to one of the eastern suburbs. They passed through a paved street, full of manufacturers, shop-keepers, and purchasers.— The party were about a quarter of an hour passing through this suburb, when they came before the walls of Pekin. The ambassador's arrival was announced by the firing of guns; and refreshments were provided for the suite, at a resting place inside of the gate. The walls near it were paved with stone, but in other places with brick. Over the gate was a high watch-tower of several stories, each having sham port-holes painted on them. Outside of the gate was a semicircular wall, having a lateral gate, which, bearing a resemblance to the European plan of fortification, is probably a late addition. The walls of the city were about 40 feet high. The parapet was deeply crenated, but without regular embrazures, nor were any cannon seen on the walls; but in the mertons, there were loop-holes for archery. At the base, the walls were about 20 feet thick; and across the terepleine, on which stood the parapet, 12. The outside of the wall, though not quite perpendicular, was smooth, but the inside sloped considerably; the rows of bricks, of which it is built, being ranged like steps, one above and behind the other. Square towers flanked the outside of the walls, the distance between each being about 60 yards, and the projection of the curtain between them 40 or 50 feet. Many horsemen might ride abreast on the ramparts, the ascent to which is by slopes of earth withinside.

No seats or villas.

Walls of Pekin.

City of Pekin.

" On the entrance of this city, it appeared different from those of Europe, the streets of which are frequently so narrow, and the houses so high, that at one end of a street, the houses at the other seem to lean, and to bear towards those opposite. Here the houses were mostly of one story, and none above two, while the street itself was much above 100 feet in breadth. It exhibited also a gay and jovial appearance. As the street had no pavement, water was thrown upon it, to allay the dust. Across it stood a good building, called here Pailoo, which has been erroneously rendered a triumphal arch; it was built entirely of wood, and consisted of three gateways, the largest of which is in the middle; over these were three roofs, one above another, highly adorned. The design of this structure was expressed by large characters, painted and gilt on the uprights and transoms. They are erected to celebrate particular persons, or some important events.

"The first street ran in a regular line westerly, till it came to the eastern wall of the palace, which is termed the yellow wall, from the colour of the tiles with which the top is covered.

"Several public structures were thus covered. These roofs had no chimnies, and the sides and ridges were ornamented with various figures; the whole shining like gold, gave the appearance of grandeur in that part of houses where it was unusual. Near the gate were large stores of rice. Looking hence to the left, along the wall of the city, an elevated building was seen, said to be an observatory erected by the Emperor Yong-loo, to whom Pekin owes much of its improvements. The shops were highly decorated, and in a grand style. Some had on the top broad terraces, filled with flowers and shrubs. In the fronts were lanthorns of horn, muslin, silk, and paper, in frames of different figures. Goods were exposed to sale, as well on the outside of the shops as within." P. 311, 312, and 313.

"On arriving at the eastern side of the yellow wall, the embassy diverged to the right, and then the bustle decreased. There were no shops in this quarter; each house had in front a wall to screen the inner court from being seen, which is called the wall of respect. Near the middle of this side of the palace are treble gates, where the party halted. The space of ground was large. Some of the ground was raised into steep hills; and the spots from whence the earth was taken to form them were filled with water. In these lakes were small islands, decorated with fanciful buildings, and interspersed with trees. On the hills were the imperial palaces; and on the top of the highest were summer houses and cabinets, surrounded with tall trees.

"On looking to the north from this spot, at the end of a street running to the city wall, appeared the lofty structure, in which is an enormous bell, of a cylindrical shape, the sound of which, when struck on the outside with a wooden mallet, is heard in every part of the city. A little further to the westward of it was one of the northern gates, the watch tower on which was seen above the intervening houses. Beyond the palace gates to the westward, between the yellow wall and the northern part of the city, is a large lake, which, at this time, was nearly covered with the leaf of the Lien-wha." Pp. 314, 315.

"Many of the streets were narrow, having gates at the entrance, near which guards were posted to preserve peace. These gates are shut at night, and are not opened but upon emergency. The party crossed one street four miles long, from north to south, being interrupted only by several Pai-loos." P. 316.

Palace.

The palace at Pekin "was built in the usual manner of the houses of the great mandarins, and the whole was in the form of a long square, surrounded by a brick wall, the surface of which was a mere blank, except near one of the angles, where there was a gateway. This wall supported the top ridge of roofs; the lower edges of which, resting on an inner wall parallel to the first, composed a range of buildings divided into offices. In the other part of the inclosure were quadrangular courts of different sizes. In each of which were buildings, on platforms of granite, surrounded by a colonnade. The columns were of wood, about sixteen feet high, and about an equal number of inches at the base, lessening at the top about 1-6th. These had none of the properties of the Grecian architecture. At the lower ends, they were let into sockets cut in stones, forming a ring round each, somewhat resembling the Tuscan order. Between the columns, which were red, was wood-work, carved and ornamented, of a different colour. This colonnade supported the projecting part of the roof beyond the wall plate, of a curvilineal form, and turned up at the angles; thus every part of these buildings might be visited under cover. The number of pillars was at least 600. Next to the chief apartment allotted to the ambassador, was a high building, designed for a private theatre and concert-room, having all round a gallery for spectators, and retiring rooms behind.

"All the buildings were of one story, except that which was appropriated for the ladies. This was in the inner quadrangle. The front was a long and high wall, the windows of which were of Corea paper. Behind this hall was a gallery, at the height of near 10 feet, leading to several small apartments, lighted only from the hall. The windows within were of silk gauze, in wooden frames, either ornamented with needle work, or painted in water colours. This apartment, though smaller, was neater than most of the rest. A small black court, with offices, was attached to this part of the building. One of the outer quadrangles had a piece of water, in the middle of which was a stone room, in the shape of a covered barge. Others of the quadrangles were adorned with trees, and in the largest was a heap of rocks, firmly, but rudely piled on each other; and at one end was a small unfinished garden." P. 322-3.

"This city also contains the Tien-tan, or eminence of heaven. On this building is inscribed the character tien, or heaven. It is circular, to represent the concave of heaven, as the Tee-tan, or temple of the earth, is square, agreeable to the notions of the ancient Chinese." P. 327.

Another palace.

Palace between Hai-tien and Yuen-min-yuen. "It was settled that the chief articles should be placed on each side of the throne, in a hall of audience. This hall was very magnificent on the outside. Its approach was through three quadrangular courts, surrounded by separate buildings. It stood on a platform of granite, which was about four feet above the court in front. The roof was supported by a double row of wooden pillars, painted red and varnished, and the capitals decorated with different figures, highly coloured, especially with dragons, the feet of each having five claws. The figures of these monsters, exhibited on the houses and furniture of the princes of the court, have but four claws, the fifth being reserved for the emperor only. The entablature of the edifice is encompassed with a net of gilt wire, to keep off the birds from settling on any of the projections. The hall withinside is above 100 feet long, upwards of 40 broad, and above 20 in height. Opening pannels are placed between the inmost row of pillars on the south side." P. 317-8.

Farm house.

Farm house at Lowang. "In the way they were invited into a farm house by the tenant, who, with his son, regarded them with astonishment. The house was of wood, the uprights of which were of the natural form of the timber. The roof, which was without a ceiling, was covered with the straw of rice. The floor was of earth beat hard, and the rooms were divided by mats hanging from the beams. Two cotton spinning wheels were in the outermost; but the females had retired. Clusters of bamboo grew round the house, and also the sort of palm whose leaf resembles a fan, and is used as such." P. 173.

"The houses near the river (Pei-hoo) appeared as if they were built of mud, but on a nearer examination they

Houses built of brick baked in the sun.

were found to be of bricks baked in the sun, which, as well as the tiles on the roofs, were afterwards plastered with a substance like mud. There is no lime except from sea shells or stones, to be had at any great distance from the river, and a pebble is accounted a rarity." P. 217.

"The houses were mostly built of a lead coloured brick; those of the meanest habitations were of pale brown, and very few were red.

Different sorts of bricks.

"These different colours have probably arisen from the method of making the bricks. The brown had only been exposed to the solar heat; the blue to a wood fire in kilns, without being affected by the flames; while the red had sustained the force of the flame. On moulding the clay into its proper form, it is the eastern custom to lay the bricks in regular rows upon one another, having layers of straw between each range. Many houses here have two stories, contrary to the Chinese mode in general." P. 277-8.

Villages.

"The houses in most villages were enclosed with a fence made of the stems of the Kow-leang. Some of these villages are as large as European cities, but none are reckoned of note here, except such as are walled round.

Walls mostly of mud.

Roofs thatched with straw.

Court formed by wattles.

Habitations regulated by law.

Manner of building.

Larch fir.

Windows of paper.

Floors of marble or earth.

Galleries.

Distribution of apartments.

"During this slow progress, hardly half an hour passed without bringing a town or village to view. The walls of the houses in the last were mostly of mud, baked in the sun, or moulded between planks, and bound with them till it was hard enough to bear a roof; or of wicker work, coated with clay. The roofs were, in few instances, covered with green turf, but more generally with straw. The rooms were divided with lattice work, hung with broad paper, ornamented with images or moral sentences. Each house has a court round it, enclosed with wattles, or the stem of the kow-leang. Neatness and order characterised the whole. The walls that surrounded the towns were usually higher than the roofs of the houses within, and generally formed a square, facing the four cardinal points, with a gate in each. The streets were mostly narrow. The few large buildings were either for public uses, or the dwellings of men in office. The habitations, as well as the dress of the great, are regulated by particular laws, and with an especial regard to the convenience of the poor. The houses were generally plain, and of one story, the foundations being of freestone or granite, brought from the adjacent mountains. The walls were mostly of brick, and the roofs covered with rows of tiles, alternately concave and convex, cemented by clay. The larch fir is chiefly used in building. The windows are small, and made of paper. So little is iron used, that hardly a nail is to be seen in any houses. The floors are of marble or indurated earth. In more elegant buildings, a range of pillars, made of the trunks of firs, ran parallel to the outer walls, and formed a gallery. Thus the body of the roof rests on the walls, and the projecting part on the pillars. In some structures are double or treble roofs, a few feet above each other. The chief doors and windows of public buildings look to the south. These are, chiefly, a hall of audience for the administration of justice, college for students, temples, granaries to hold supplies against scarcity, and a public library. Common houses have no columns, but the shops have two poles crossed with boards, on which are inscriptions and representations of what are sold within.

"The furniture is simple, and the ornaments are few. Whatever is made of wood is painted red and varnished. These towns all exhibited the bustle of commerce. Trading vessels were constantly passing on the river." P. 390, 391.

Plate CLVI.

Plate CLV.

In Plate CLVI. we have given a view of the viceroy's palace at Canton, which Patrick Begbie, Esq. of Castlehill, has been so obliging as to permit us to copy, from a drawing he had made by a Chinese upon the spot. This, though very deficient in the perspective, appears to have been performed with the minute attention peculiar to that people. The architecture is in a meaner style than that of the pagodas shewn in Plate CLV.; but Europeans not being admitted into these places, this view is valuable, as exhibiting the disposition of their paltry sheds and ridiculous decorations; and likewise of the dress and positions assumed during some of their processions.

General remarks.

The impressions from these descriptions are certainly very different; but, from the whole, we may conclude, that a time has been when the whole of China was modelled by a people previously accustomed to live in tents; and that if any other mode ever did prevail, it has been completely annihilated. The Chinese cities have not, as in most other countries, that irregularity which is the result of rising from small beginnings, and under varying circumstances; on the contrary, they have precisely the same formality of character as if their plans had been previously arranged, and carried into effect under the controul of despotism; the tent having been rendered a fixed habitation, the patriarchal government directing every operation by fixed rules, and never permitting their notions to be disturbed by foreign intercourse. Chinese skill has been limited to dexterity and neatness in the whimsical decoration of the trifling members of tent architecture; instead, therefore, of rousing genius by public estimation and rewards, it has been repressed by custom and arbitrary enactments. The utmost of their exertions in architecture appears in their city gateways, which having no prototype in tent encampments, were, in some measure, left for genius to invent; but the system of precedent was too powerfully rooted to suffer even this to proceed beyond the demands of absolute necessity, and a system of gateways was also established. The same unpropitious regulations pervades all ranks, from the mandarin to the peasant; the former barely enjoying a precarious comfort, and the latter too generally existing in wretchedness, justify, we suspect too frequently, Mr Barrow's remarks. With the feelings which such reflections must unavoidably excite, he has possibly been led to notice and describe, rather unfavourable traits of the Chinese; but if we refer to the evidently partial descriptions of Duhalde, Le Compte, and Chambers, they present only gaudy, superficial, and trifling operations, adapted to the early stages of civilization, or the childish years of more advanced society. Although this style is totally unfit for producing impressions of dignity, sublimity, or strength, yet some of its features are admirably calculated for scenes of gaiety and festivity. Nothing can be more airy and elegant than a slender colonnaded building, raised upon a properly constructed basement, surrounded by slight curved roofs of varnished tyles, light latticed galleries, and crowned with a small open cupola, with a pierced globe and flower at the top; it seems scarcely attached to the earth; and, in country habitations, for the middle ranks of society, instead of aping the gigantic members of Greek and Roman temples, the Chinese mode of arrangement in two stories only, with their simple and unassuming members, seem deserving of attention. This climate will not admit of the precise forms or distribution being adopted, but the ingenious architect will be at no loss to preserve the character, and at the same time construct an appropriate edifice.

Greek, Roman, and Modern Architecture.

Greek. Having, we presume, made the attentive reader sufficiently acquainted with Egyptian, Indian, Persian, and Chinese architecture, we shall proceed to define another mode, more generally known and practised by Europeans: this, strictly speaking, ought to be denominated Greek architecture; but although all the principal features and modes of application are Greek, yet as the Romans also practised this school of the art very extensively, and likewise introduced new features and modes of application, they have deservedly acquired a share in the title.

General remarks. In treating this part of the subject fully and explicitly, we find that, on account of the modes practised by the ancients, having, with some slight shades of difference, been also adopted by the moderns, it is impracticable to keep them perfectly distinct; but we shall endeavour, in every section, first to point out the ancient practice, and add what has been introduced by the moderns in the course of the progress of the arts and sciences, and the total change of habits in society.

Of Materials.

It is chiefly from the valuable work of Vitruvius, that we are furnished with information respecting the nature of the materials used by the Greeks and Romans, and of the particular modes in which they were disposed in their buildings. From the accounts published by modern travellers and scientific artists, we are also furnished with further information respecting the practice of these people.

Materials. The materials chiefly made use of by them were *timber, marble, stone, bricks, lime,* and *metals.*

Timber. With regard to *timber,* the proper time for felling was reckoned from the beginning of autumn to the latter end of February, when the moon was in the wane. They considered wood when quite green, or too much dried, as equally unfit for working. For joists, doors, windows, they required that it should have been cut three years, and kept for a considerable time covered with cow-dung.

Marbles. The Greeks most usually made use of white marbles, as Pentilic, Parian, and that of Chios. The latter was very transparent.

The Romans employed many sorts, of various colours, and procured from many different countries, which were subjected to them in Asia, Africa, and Europe.

The ancients frequently included under the term marble, all hard stones which would receive a smooth fine polish; the moderns confine the name marble to such calcareous stones as are capable of receiving a fine polish.

Alabaster. This substance resembled marble in taking a smooth fine polish, but it is much softer and more easily worked. Gypseous alabaster, when polished, is slippery to the touch; it frequently contained as much carbonate of lime as to cause it to effervesce with acids; it was procured from Upper Egypt between the Nile and Red Sea, also from Syria and Carmania. The calcareous alabaster is white, yellow, red, and bluish grey; the fracture is striated or fibrous, in hardness inferior to marble; it is known under the denomination of common and oriental; Italy and Spain produce the best.

Stone. The stone which was employed appears to have differed very materially in its qualities; some becoming considerably harder in being exposed to the air, was worked immediately on being taken out of the quarry; but there was some of a softer kind, which, previous to being used, required to have its quality proved by two years exposure to the effects of the atmosphere.

Tiles. Of *tiles,* they had, 1. The unburnt kind, which were dried five years in the sun; and, 2. Those baked by fire, after having been made two years, they preferred a white chalky earth dug in the autumn, exposed during the winter, and made into bricks in the spring. The Greeks proportioned the size of the bricks to the nature of the edifice: the largest for public buildings, were five spans each way; those of the middle class were four spans; and the smallest, called by Vitruvius, *Diodori,* or by Pliny, *Lydii,* were two spans long and a foot broad; these last were for private houses.

It appears that those dried in the sun were mixed with chopped straw. Dr Pocock describes one of the pyramids constructed of brick: he measured some 13½ inches long, 6¼ inches broad, and 4 inches thick; also others, which were 15 inches long, 7 inches broad, and 4¾ inches thick. At Rome they were found by De Quincey of three different sizes; the least were 7½ inches square, and 1½ inch thick; the middle-sized were 16½ inches square, and 18 to 20 lines in thickness; and the largest were 22 inches square, and 21 to 22 lines in thickness.

Sand. Three kinds of *sand* are mentioned, that is, pit, river, and sea sand; of these, pit sand was reckoned the best; the white was preferred to the black or red-coloured, and the carbuncle to all; of the river sand, that was considered best which was found near torrents; the least value was put upon sea sand, and it was required to be well washed, to dissolve the saline matter before used in plastering or rough casting walls.

Lime. *Lime* for plastering walls was made from shells, river-pebbles, or a sort of pumice stone; the best sort of lime was accounted that made from white stone, which was dense and hard, and lost one-third of its weight in burning in a kiln, where it was kept about sixty hours. Their mortar was composed of one part lime and three of pit or two of river sand.

Metals. *Metals* were used, 1. Iron for chains, hinges, handles, and nails. 2. Lead for roofs, pipes. 3. Copper and brass were still more used for many of these purposes, or, 4. *Copper, brass,* and *lead,* mixed into a bronze for statues, bases, and capitals of columns, and in doors.

Moderns. Amongst the moderns, change of climate, natural productions, and the habits of mankind, have from time to time led to considerable changes in the kinds of materials used for the various purposes of architecture, also in the modes of preparation, and application of them.

Timber. General remarks. With regard to *timber.* Oak, for the greatest strength and durability, should be chosen from those soils where it has taken the longest time in arriving at maturity, and of two pieces equally dry, that should be chosen which has the greatest specific gravity, and that which will have its specific gravity least changed by being soaked in water: this observation will indeed apply to timber in general. A decay of the top is almost a certain indication of a decay of the tree; and a decayed branch or rotten stump bespeaks a defect in that part of the tree where it is situated. In a similar soil, trees which grow near the outside of a forest will be more durable than those near the middle of it; and in the same tree, the side which grew towards the north will be stronger than the south side.

When perfection of strength and texture is alone consulted, all sorts of timber are cut down in the winter, being at that time freest of sap, and most readily seasoned, and rendered fit for the purposes of building; but on account of the bark of the oak being of great use in tanning leather, that wood is always, in England, cut in the spring, or rather from April to June, according to the state of the season, and soon after the sap begins to ascend and the leaf to appear; if it is cut before the sap rises, the bark adheres to the wood, and cannot be stripped off, and if left until the leaf is quite expanded, the bark is less valuable; when the tree is felled and suffered to lie in the trunk, it will shrink in size, but this is probably from its discharging water, because, if a dry tree be laid in a damp place, it will increase both in weight and size. The part called the sap varies in quantity in different trees; it is least in bad soils, where the growth is slow; it is of very little use.

Oak. Oak, used in damp situations, appears to decay gradually from the external surface to the centre of the tree; the outside ring or addition it received in the last year of its growth decaying first, and afterwards that next within it, and then the following one. This appears to proceed from two causes; first, from the outward ring being, where whole trees are used, first exposed to the action of the atmosphere, which cannot reach the second until the first is destroyed; secondly, from the centre part of the tree having arrived at a greater degree of maturity than the outward rings, which are many years younger. But this must be understood only of trees which are not past their prime before they are cut down; for when a tree begins to decay from age, that part of the tree which is oldest, namely the central part, decays first; to this succeeds the parts which are next oldest, being the ring next the centre, and the other annual rings in succession gradually approaching the bark. A judicious builder will therefore, in the choice of his timber, always carefully examine the central part of the tree, especially of that which is next the root, and more particularly if the tree is large, and has the appearance of great age.

Seasoning. The best mode of seasoning oak is to put it in water. This, if in the log, should be done for a whole year or more, but, if cut in planks, less time is necessary; in either case, alternate soaking and drying is to be preferred. This, in planks, is very practicable; but, in regard to logs, one soaking and drying gradually in the shade, is, on account of the great labour attending the operation, most generally practised. After the planks have been soaked in water, they are dried by placing a strong pole in a horizontal position, at such a height as will admit of one end of each plank being placed on the ground, and the other resting against the pole edgewise, placing a plank first on one side of the pole, and then another on the other side alternately, thus leaving a space for the air to pass freely and dry them, and being exposed edgewise to the sun, they are not liable to split.

Ash. In ash, there is little difference in the quality through the whole thickness of the tree, the outside is rather the toughest: it soon rots when exposed to the weather, but will last long when protected.

Elm. Of elm, some sort will decay sooner than the brown or red. It is improper for roofs or floors, being generally cross-grained, and very liable to warp; it also shrinks very considerably, not only in breadth, but lengthwise. It answers well when used under water; it is not liable to split, and bears the driving of bolts and nails better than any other timber.

Beech. *Beech* is hard and close. There is a black or brown, and a white kind: the brown is tough, and sometimes used as a substitute for ash; it is improper for beams, because a small degree of dampness in the walls very soon rots the ends; it is fittest for furniture, or where constantly under water.

Poplar. *Poplar* is of a very close quality, is liable to the same objections as the beech in beams, but is well adapted for floors and stairs, being not readily inflamed: it rots soon when exposed to the weather.

Asp. *Asp* resembles the poplar in appearance; it is soft and tough; it lasts when exposed to the weather; it is equally good through the body of the tree.

Sycamore. The *Sycamore* and *Lime* are subject to the same objections, in roofing and flooring timbers, as the poplar and beech. The lime is something like the ash, and, like it, is greasy when worked smooth: It is suitable for furniture.

Birch. *Birch* is equal in quality quite across the body of the tree; it is very tough, but does not last when exposed to the weather; it is also subject to be destroyed by the worms.

Chesnut. *Chesnut*, viz. the sweet, or Spanish, (not the horse-chesnut,) is frequently found in old buildings in England; and although difficult to be distinguished from oak, differs from it in this, that wherever a nail or bolt has been driven into oak before it was dry, a black substance appears round the iron, which is not the case in chesnut.

Walnut. The *Walnut-tree* is, in Britain, now too valuable to be used in the framings of roofs or floors, and in furniture it has long been superseded by mahogany; it is now used chiefly in stocks of firelocks, fowling-pieces, pistols, &c.

Mahogany. *Mahogany* is used chiefly in furniture, but also sometimes in doors and window sashes; it is sawn out and seasoned by perching out in the winter, and drying in the open air, the use of fire is not advisable. This beautiful timber was introduced into England about the beginning of the last century: its first application was in a box for holding candles, made by a Mr Wollaston for a Dr Gibbons, who had afterwards a bureau of it; the Duchess of Buckingham had the second bureau. It very soon came into general use. It is divided chiefly into Jamaica and Honduras; the former is by much the hardest and most beautiful: they may be readily distinguished before they are oiled; the pores of the Honduras appear quite dark, those of the Jamaica as if filled with chalk.

Fir. *Fir*, being cheaper, and more easily wrought than oak, and next to it in usefulness, is more used in Britain than any other kind of timber. That most generally employed in carpentry is distinguished by the name of Memel, (which includes Dantzic and Riga); Norway, (which also includes Swedish,) is much used for the smaller timbers, and answers well either when exposed to the air, or under ground. Dranton, or Dram, is suitable for flooring. All these are very durable. American fir is much softer, but suits inside joinery work, such as pannels and mouldings. What is termed in England *white deal*, and in Scotland *pine wood*, that is, fir deprived of its resinous part, being very durable when kept dry, is much used by cabinet-makers; but, as it will not stand the weather, it is little used in carpentry or joinery.

Evelyn makes the following observation on the use of fir:—"That which comes from Bergen, Swinsund, Mott, Longland, Dranton, (called Dram,) being long, straight, and clear, of a yellow and more cedary colour, is esteemed much before the white for flooring and wainscot; for masts, those of Prussia, which we call spruce, and Norway, especially from Gottenburgh, and about Riga, are the best."

The torulus, as Vitruvius terms it, and heart of deal kept dry, rejecting the alburnum or white, is everlasting;

nor is there any wood which so well agrees with the glue, or which is so easy to be wrought. It is also excellent for beams, and other timber work in houses, being both high and exceedingly strong, and therefore of very great use for bars and bolts of doors, as well as for doors themselves; and, for the beams of coaches, a board of an inch and a half thick will carry the body of a heavy coach with great ease, by reason of a natural spring which is not easily injured. It was formerly used for carts and other carriages, and also for the piles to build upon in boggy grounds. Most of Venice and Amsterdam is built upon them. For scaffolding also, there is none comparable to it. Under the head of fir may be classed *cedar*, a wood of great durability, but too expensive to be used in Britain.

General Observations respecting Timber.

Evelyn makes the following observations upon timber; some of which are well worthy of attention:—

General observations.

"Lay up your timber very dry, in an airy place, yet out of the wind or sun, and not standing upright, but lying along, one piece upon another, interposing some short blocks between them, to preserve them from a certain mouldiness which they usually contract while they sweat, and which frequently produces a kind of fungus, especially if there be any sappy parts remaining.

"Some there are yet, who keep their timber as moist as they can by submerging it in water, where they let it imbibe to hinder the cleaving; and this is good in fir, both for the better stripping and seasoning, yea, and not only in fir, but other timber. Lay, therefore, your boards a fortnight in the water, (if running the better, as at some mill pond head,) and then setting them upright in the sun and wind, so as it may freely pass through them, (especially during the heats of summer, which is the time of finishing buildings,) turn them daily, and thus treated, even newly sawn boards will floor far better than a many years dry seasoning, as they call it. But, to prevent all possible accidents, when you lay your floors, let the joints be shot, fitted, and tacked down only for the first year, nailing them for good and all the next; and by this means they will lie staunch, close, and without shrinking in the least, as if they were all one piece. And upon this occasion, I am to add an observation which may prove of no small use to builders; that if one take up deal boards that may have lain in the floor an hundred years, and shoot them again, they will certainly shrink (*toties quoties*), without the former method. Amongst wheel-wrights, the water seasoning is of especial regard; and in such esteem amongst some, that I am assured, the Venetians, for their provision in the arsenal, lay their oak some years in water before they employ it. Indeed, the Turks not only fell at all times of the year, without any regard to the season, but employ their timber green and unseasoned; so that, though they have excellent oak, it decays in a short time by this only neglect.

"Elm felled ever so green, for sudden use, if plunged four or five days in water, (especially salt water,) obtains an admirable seasoning, and may immediately be used. I the oftener insist on this water seasoning, not only as a remedy against the worm, but for its efficacy against warping and distortions of timber, whether used within or exposed to the air. Some, again, commend burying in the earth, others in wheat; and there be seasonings of the fire, as for the scorching and hardening of piles, which are to stand either in the water or in the earth.[*]

"For that to most timber it contributes much to its duration. Thus, do all the elements contribute to the art of seasoning. . . . .

"And yet even the greenest timber is sometimes desirable for such as carve and turn, but it chokes the teeth of our saws; and for doors, windows, floors, and other close works, it is altogether to be rejected, especially where walnut trees is the material, which will be sure to shrink. Therefore, it is best to choose such as is of two or three years seasoning, and that is neither moist nor over dry;—the mean is best. Sir Hugh Plat informs us, that the Venetians use to burn and scorch their timber in a flaming fire, continually turning it round with an engine, till they have gotten upon it an hard black coaly crust; and the secret carries with it great probability, for the wood is brought by it to such a hardness and dryness, that neither earth nor water can penetrate it; I myself remembering to have seen charcoal dug out of the ground amongst the ruins of ancient buildings, which had in all probability lain covered with earth above fifteen hundred years.

"Timber which is cleft is nothing so obnoxious to reft and cleave as what is hewn; nor that which is squared as what is round; and therefore, where use is to be made of huge and massy columns, let them be bored through from end to end. It is an excellent preservative from splitting, and not unphilosophical; though, to cure the accident, painters putty is recommended; also, the rubbing them over with a wax-cloth is good; or before it be converted, the smearing the timber over with cow dung, which prevents the effects both of sun and air upon it, if, of necessity, it must lie exposed. But, besides the former remedies, I find this for the closing of the chops and clefts of green timber, to anoint and supple it with the fat of powdered beef broth, with which it must be well soaked, and the chasms filled with sponges dipt into it. This to be twice done over.

"Some carpenters make use of grease and saw-dust mingled; but the first is so good a way," says my author, "that I have seen wind shock timber so exquisitely closed, as not to be discerned where the defects were. This must be used when the timber is green.

"We spake before of squaring; and I would now recommend the quartering of such trees, as will allow useful and competent scantlings, to be of much more durableness and effect for strength, than where (as custom is, and for want of observation) whole beams and timbers are applied in ships or houses, with slab and all about them, upon false suppositions of strength beyond these quarters. For there is in all trees an evident interstice or separation between the heart and the rest of the body, which renders it much more obnoxious to decay and miscarry, than when they are treated and converted as I have described it; and it would likewise save a world of materials in the building of great ships, where so much excellent timber is hewed away to spoil, were it more in practice. Finally,

"I must not omit to take notice of the coating of timber in work used by the Hollanders, for the preservation of their gates, portcullises, draw-bridges, sluices, and other huge beams and contignations of timber, exposed to the sun and perpetual injuries of the weather, by a certain mixture of pitch and tar, upon which they strew small pieces of cockle and other shells, beaten almost to powder, and mingled with sea-sand, or the scales of iron, beaten small and sifted, which incrusts, and arms it, after an incredible manner, against all these assaults and foreign invaders; but if this should be deemed more obnoxious to firing, I have heard that a wash made of alum has wonderfully protected it against the assault even of that devouring element; and that so a wooden tower or fort at the Piræum, the port of Athens, was defended by Archelaus, a commander of Mithridates, against the great Sylla. But you have several compositions for this purpose, in that incomparable Treatise of Naval architecture, written in Low Dutch by N. Witsen, Part I. chap. vi. The book is in folio, and he that should well translate it into our language (which I much wonder has not yet been done) would deserve well of the public.

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[*] When wood is charred, it becomes uncorruptible; for which reason, when we wish to preserve piles from decay, they should be charred on their outside. Oak posts, used in inclosures, always decay about two inches above and below the surface. Charring that part would probably add several years to the duration of the wood.

"Timber that you have occasion to lay in mortar, or which is in any part contiguous to lime, as doors, window-cases, groundsels, and the extremities of beams, &c. have sometimes been capped with molten pitch, as a marvellous preserver of it from the burning and destructive effects of the lime; but it has since been found rather to heat and decay them, by hindering the transudation which those parts require; better supplied with loam, or strewings of brick-dust, or pieces of boards; some leave a small hole for the air. But though lime be so destructive whilst timber lies thus dry, it seems they mingle it with hair, to keep the worm out of ships, which they sheath for southern voyages, though it is held much to retard their course. Wherefore, the Portuguese scorch them with fire, which often proves very dangerous; and, indeed, their timber being harder, is not so easily penetrable.

"For all uses, that timber is esteemed the best, which is the most ponderous, and which, lying long, makes deepest impression in the earth, or in the water, being floated; also, what is without knots, yet firm, and free from sap, which is that fatty, whiter, and softer part, called by the ancients alburnum, which you are diligently to hew away.

"My Lord Bacon, Exper. 658, recommends for trial, of a sound or knotty piece of timber, to cause one to speak at one of the extremes to his companion, listening at the other; for if it be knotty, the sound, says he, will come abrupt.

"For the place of growth, that timber is esteemed best which grows most in the sun, and on a dry and hale ground; for those trees which suck and drink little are most hard, robust, and longer lived—instances of sobriety. The climate contributes much to its quality; and the northern situation is preferred to the rest of the quarters; so as that which grew in Tuscany was of old thought better than that of the Venetian side; and yet the Biscay timber is esteemed better than what they have from colder countries; and trees of the wilder kind and barren, than the over much cultivated and great bearers."

Dr Parry has published an excellent paper on the causes of the decay of wood, and the means of preventing it. From it we take the liberty of abridging what follows; but would recommend a careful perusal of the whole of it to those who wish for further information on the subject.[*]

Decay.

Wood Dr Parry supposes to be subject to destruction from two causes, rotting and the depredations of insects. Of rot there are two supposed kinds, the first takes place in the open air; the second under cover.

When perfectly dry, and in a certain degree of temperature, both animal and vegetable matters seems scarcely capable of spontaneous decay. On this principle, fish and other animal matter is often preserved.

"Similar causes produce the same effects on wood. Even under less rigid circumstances of this kind, as in the roofs and other timber of large buildings, it continues for an astonishing length of time unchanged. Witness the timber of that noble edifice, Westminster-hall, built by Richard II. in 1397; and the more extraordinary instance quoted by Dr Darwin, in his ingenious work the *Phytologia*, of the gates of the old St Peter's church in Rome, which were said to have continued without rotting, from the time of the Emperor Constantine to that of Pope Eugene IV. a period of eleven hundred years. On the other hand, wood will remain for ages, with little change, when continually immersed in water, or even when deeply buried in the earth, as in the piles and buttresses of bridges, and in various morasses. These latter facts seem to show, that if the access of atmospherical air is not necessary to the decay of wood, it is at least highly conducive to it."

Putrefaction.

Putrefaction is the cause of rotting, and putrefaction is occasioned by stagnant air and moisture. The moisture of the air, coming in contact with wood of a lower temperature, is condensed in the same manner, as is more visible in our glass windows. In order to prevent the bad effects of this condensation, currents of dry air ought to be made to pass in contact with the timber. Of the advantages of this, the Gothic architects seemed aware; for it was common with them to leave openings for this purpose—a practice which we could strongly recommend in cellars, &c.

"It appears that the contact of water and air are the chief causes of the decay of wood. If, therefore, any means can be devised, by which the access of moisture and air can be prevented, the wood is so far secure against decay. This principle may be illustrated, by supposing a cylinder of dry wood to be placed in a glass tube or case which it exactly fills, and the two ends of which are, as it is called, hermetically sealed, that is, entirely closed, by uniting the melted sides of each end of the tub. Who will doubt that such a piece of wood might remain in the open air a thousand years unchanged? Or let us take a little more apposite illustration of this fact, that of amber, a native bitumen or resin, in which a variety of small flies, filaments of vegetables, and others of the most fragile substances, are seen imbedded, having been preserved from decay much longer probably than a thousand years, and with no apparent tendency to change for ten times that period."

These observations lead to the theory of painting timber, for the purpose of preserving it.

Dry rot.

Mr Batson of Limehouse is of opinion, that the dry rot proceeds from a plant, called *Boletus Lacrymans*, one of the fungus tribe, and is one of the few that have leaves as the misletoe. But Dr Parry justly observes, that these plants "*begin merely, because decayed wood is their proper soil.*"

"The smell which we perceive in going into vaults or cellars, where this process is going on, arises partly from the extrication of certain gases, mingled perhaps with some volatile oil, and partly from the effluvia of those vegetable substances, which have already been said to grow on it, and which, though they begin *merely because*

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[*] Papers of Bath and West of England Society, vol. xi. p. 226.; also Nicholson's *Journal*, No. 85, 86, and 87

the decayed wood is their proper soil, yet afterwards tend probably to the more speedy decomposition of the wood itself.

"The following, then, appears to be the whole theory of the dry rot, that it is a more or less rapid decomposition of the substance of the wood from moisture, deposited on it by condensation, to the action of which it is more disposed in certain situations than in others; and that this moisture operates most quickly on wood, which most abounds with the saccharine or fermentable principles of the sap." Thus far Dr Parry.

Charring. Charring of wood is known to be a most effectual mode of preservation against rotting.

The incorruptibility of charcoal is attested by numerous unquestionable facts. At the destruction of the famous temple at Ephesus, it was found to be erected on piles that had been charred; and the charcoal in Herculaneum, after almost 200 years, was entire and undiminished.

To this property of charred wood Sir C. Wren does not seem to have attended, when about to build St Paul's. It is said, he thought piles were not to be depended on for a foundation, excepting when always wet; and therefore dug to a great depth through a dry soil, in order to come at a solid foundation for part of that cathedral. See Wren's *Parentalia*.

Charcoal. Charcoal has also been found useful as a defence to the surface of wood when used as a paint. We lately had a good instance of the effect of sand used for this purpose. At Studly Royal we saw a temple to appearance of stone, but which on examination we found to be wood covered with paint, and dusted over with sand. We were informed it had stood about 50 years; and the deception was still so complete, that the spectators supposed the pillars to be stone, till minutely examined.

Stone. From *marble* being plentiful in Italy and France, these countries have been able to make a considerable use of it, even in the main walls of their edifices; but being seldom found in sufficient quantities, and of proper quality, in the more northern parts of Europe, it has been here chiefly confined to interior columns, pavements, chimney-pieces, and sometimes stairs.

The kinds of *stone* are as various, as the countries in which the buildings are constructed. *Sandstone* being very generally found stratified, even in thin laminæ, being readily cut into different forms, and being, if properly selected and used, sufficiently durable, it has, in northern countries, been in most frequent use. It is a general accompaniment of coal strata, and is also often found where the latter does not occur. It varies in its component parts, being at different places argillaceous, siliceous, and calcareous. Its position, in the earth, assumes all directions, from the horizontal to a vertical plane. The proportional thickness of its strata, laminæ, or beds, varies from that of thin slate to many feet each. The upper beds are usually very thin or soft, or both; if sufficiently hard, they are employed in floor pavements and covering roofs. Under these the beds generally, in useful quarries, increase in thickness, hardness, and tenacity. The position of the laminæ always require strict attention, that the worked stone may, if possible, be laid in the building upon its natural bed; for although some instances occur, as in the Isle of Portland and at Grinshill, in Shropshire, where the difference is not apparently great, yet in all stone (even granite) it is sufficiently well known to workmen. Some stone, as that of Bath, is so soft when taken out of the quarry, as to be very conveniently worked with tools resembling those used by carpenters; yet when exposed for some time to the atmosphere, it becomes hard and durable. This last, indeed, cannot be deemed sand stone, being nearly altogether calcareous.

Stone from Tottenhoe. Besides the before mentioned, there is a very beautiful stone, dug in the hills near Dunstable, in the parish of Tottenhoe, from whence the stone receives its name. It has the appearance of indurated chalk. It is easily worked, and hardens by exposure to the weather. It should, however, be placed upon a plinth of some other stone, or kept by other means from contact with the ground, otherwise it is, in this situation, liable to be injured by the frosts. The house of the Duke of Bedford, at Woburn Abbey, is built chiefly with this stone, and various other large houses in the neighbourhood of the quarries. Proofs of its durability may be seen in many old churches. From the closeness of its texture, the beauty of its colour, and the facility with which it is worked into mouldings, &c. it is peculiarly fit for house-building, both externally and internally. It may now readily be conveyed to London, by means of the Grand Junction Canal.

The very perfect preservation of many beautiful churches in the counties of Lincoln, Rutland, and Northampton, are evidence of the excellence of the stone of which they are built.

Stone in Scotland. In the central parts of Scotland, different varieties of sandstone, which accompany coal, are used extensively in building houses, &c.; and this circumstance has not a little contributed to the fine appearance of the new streets, squares, and public buildings in the cities of Edinburgh and Glasgow.

Flints. Flints, where they abound, and where other stone is scarce, are sometimes used in walls of considerable height; and notwithstanding their small size, and irregularity of shape, are broken so as to compose a face of considerable smoothness. The church and steeple of Rickmansworth, in Hertfordshire, affords a fine specimen of this kind of building. But bricks or squared stones are generally used as quoins for this sort of work.

Granite. In Scotland and Sweden granite is made use of as a building material. It lies in large masses, generally separated by gunpowder into moderate, though still large dimensions, which are again cut into suitable scantlings, by means of iron instruments called plugs and feathers. They are not only worked into plain square forms, but also mouldings of considerable delicacy, by means of pointed tools of different sizes and weights. **Aberdeen granite.** At Aberdeen, in Scotland, where excellent granite is produced, and the working of it brought perhaps to the greatest perfection, there are handsome porticos, consisting of columns, bases, caps, and entablatures, executed in granite with great nicety. In the middle of the city a public building, whose front is composed of a full Doric order, is wholly completed with this excellent material. There are two sorts of granite, the one grey and the other red; the last being the hardest, is most difficult to work, consequently the former is most frequently employed; it consists of feldspar, mica, and quartz. It is much employed for paving the carriage way of streets, and in the curbing of the flat side pavements; also for piers and footpaths of bridges; and for facings and copings to quays and wharfs. At Aberdeen, it is employed in constructing very extensive piers, for protecting the entrance of the harbour; and in the Eddystone and Bell-Rock light-houses, it composes the facings, where they are exposed to the action of the sea.

Whin. *Whin*, *basalt*, and *schistus*, are also used in rubble work. The former dressing freely with the hammer, in one direction, may readily be formed with good faces, but not being stratified, their beds are uncertain, and not easily improved by art; the latter, that is schistus, is just the reverse, having naturally good beds, but being, in few instances, willing to dress square across the laminæ: They are, indeed, where expence is not an object, worked to a face by the laborious operation of striking perpendicularly with a wedge-mouthed hammer or stone-axe: Both kinds are laid, sometimes promiscuously, and at others in regular courses.

Limestone. *Limestone*, where found regularly stratified, affords good building stone, and combines the advantages of both the former, having naturally good beds, and dressing readily for a face.

Schistus. A species of schistus stone affords a covering to roofs totally unknown to the ancients, and which, when good of its kind, and properly prepared and laid on, is both very effectual and beautiful; it is, in those northern climates, an object of sufficient importance to require to be treated more at length than can, with propriety, be done in the present Section; so that we must refer the reader to the word SLATE for farther information.

Bricks. *Bricks* have, in England, become a material very generally employed in constructing all kinds of buildings. The country is provided by nature with abundant supplies of coal for burning bricks, which can, by means of the sea or numerous inland navigations, be, with great facility, conveyed to the large towns and populous districts where the demand has long been very great. Clay of proper quality is usually found, either upon the spot or immediate vicinity; a very limited number of workmen, properly arranged, can manufacture a great number of bricks in a stated time; these can readily be removed to the place where they are to be employed; being light to handle, and of a rectangular shape, the workmen lay them with facility and ease. By means of bricks, walls can be made much thinner than with almost any kind of stone, they are therefore cheaper, and occupy less space; in forming doorways, windows, chimneys, apertures and angles of all kinds, the facility they afford is greater than that of any other durable material. A building, whose walls are made with bricks, dries soon, is free from damp; and, if properly made, and thoroughly well burnt, bricks endure equal to most, and longer than many kinds of stone. The best modes of manufacturing them having already been so fully discussed, in this work, under the word BRICK, it would be superfluous to repeat them.

Tiles. *Tiles* have long been employed in England for covering the roofs of buildings situated in towns, and of farm houses and cottages in the country, but of late years the use of them has been much circumscribed by the extension of that of slates; the particular mode of manufacturing and using them, will be found under the word TILE.

Sand. Respecting *sand*, the ancient and modern practice agrees nearly in all that need be said; that which is of angular shape, hard texture, and perfectly free of earthy particles, is admitted to be best. The circumstances necessary to be attended to in employing it, have already been mentioned in the article BRIDGE.

Lime. *Lime*, as employed in mortar, has already been investigated and explained under the article BRIDGE. What regards the practical operations of quarrying and burning, will be found under the words LIME, and LIMEKILN.

Metals. In regard to *metals* in modern times, the use of *copper* and *bronze* has, in building purposes, been mostly abandoned. *Brass* has been continued in locks, pullies, sash-windows, handles, and sliding plates, connected with bells, and sundry other purposes in fitting up the interior of apartments. *Iron* has been applied to many purposes unthought of in former times. The improvement and general introduction of cast iron bids fair to create a totally new school of architecture. It has already been occasionally employed in pillars, roofs, floors, chimney, doors, and windows; and the facility with which it is moulded into different shapes, will continue to extend its application. The before-mentioned purposes, to which it has already been applied, will be more particularly noticed in the discussions of Practice in the different Branches of Architecture; and an investigation of the qualities of the material itself, as well as the mode of procuring and manufacturing it, will form a separate and important head under the word IRON.

Glass. *Glass*, as a building material, was little if at all known to the ancients, and its introduction alone has been productive of comforts and elegancies to which the most refined of the Greeks and Romans were utter strangers. Their oiled paper, transparent horn, talc, shells, and linen, would now, even to an English peasant, appear a miserable expedient. An account of the application of glass in architectural works, will frequently occur as we proceed through the several branches; but being also extensively employed in purposes totally distinct from what is connected with buildings, we must, for a general and full investigation of it, refer to the word GLASS.

Hair. Papers. Besides the materials which have already been enumerated as composing the principal members, as walls, roofs, floors, doors, windows, chimneys, stairs, and pavements; hair is also necessary in the composition of mortar for plastering the surface of the walls and ceilings; likewise various paints and papers for covering them and other parts of the work; but as these will be described, and the modes of applying them explained in their proper places, it would be improper to swell this article by entering upon the subject at present.

Definitions relating to the Orders.

Orders: Egyptian. Greeks. The moderns have applied the term *order* to those architectural forms with which the Greeks composed the façades of their temples. The principal members of an order are, 1. A platform; 2. Perpendicular supports; and, 3. A lintelling or covering connecting the tops of these supports, and crowning the edifice. The proportioning these parts to the edifice and to each other, and adapting characteristical decorations, constitutes an order, *canon*, or *rule*. We have already seen that the Egyptians employed all the principal members of an order, and also in some instances adapted very fine decorations, but they never varied the general character,—it continued uniformly to express dignified gravity. The Greeks, in the spirit of freedom, and with peculiar facility of invention, varied the expressions of their architecture as well as sculpture, and produced three species, which are denominated orders. The principal member of an order,

Column. is the perpendicular support or column. The accompaniments being subservient to this leading feature, the bottom of the column is placed either on a general artificial platform, or each upon a particular plinth, or both. The lower part of the column, which rests upon the square plinth, is sometimes encompassed with mouldings, which, in allusion to their position, are, in conjunction with the plinth, termed a *Base*. The top part of the column is also Base. covered with a square plinth, with its sides straight or curved, and generally accompanied by circular mouldings or sculptured decorations upon the top part of the column which is immediately underneath it: this, taken together, Capital.

Entablature.

Doric first Greek order.

is called the Capital. The body of the column, which reaches between the base and capital, is termed the Shaft: it is the frustrum of a cone, with sometimes a plain surface, but frequently having perpendicular flutings either meeting in an edge. or leaving a small plane space between them. The lintelling or covering, which lies upon and connects the columns, is termed the Entablature, and is sub-divided into three parts, named Architrave, Frieze, and Cornice: The architrave consists of a mere lintel laid along the tops of the columns; the frieze represents the ends of the cross beams resting upon the former, and having the spaces between filled up, having also a moulding fixed to conceal the horizontal joint, and divide it from the architrave; and the upper member or cornice represents the projecting eaves of a Greek roof, shewing the ends of the rafters. The whole is distinctly exemplified in the first Greek or Doric order; the earliest instances of which exhibit Egyptian character, and proportions adapted to the climate and materials of Greece; the column of the Doric being as gross in proportion to its height as the pillars of the Thebaid; but Greece being subject to rains, it was found necessary to elevate the whole edifice on an artificial platform, and cover it with a pointed roof, having projecting eaves, thus constituting features totally different from Egyptian. The three Greek orders, named Doric, Ionic, and Corinthian, have the same principal members, and subdivisions, but the dimensions, mouldings, and decorations, vary very considerably, as will be seen by the specimens of each, which will, in the course of this investigation, be produced.

It is only in Greece, or in the territories of Greek colonies, that pure specimens of these orders have been found. Their mouldings exhibit every specimen of conic section, as elliptical, parabolical, hyperbolical; some are merely champhered: the circle was seldom employed excepting in small cavettos and mouldings of contrary flexures.

Mouldings.

Mouldings.

Section.

Mouldings are prismatic or annular solids, formed by plain and curved surfaces, and employed as ornamental parts in most architectural operations: All parallel sections of straight mouldings, and all sections passing through the axis of annular mouldings, are equal similar figures; the forms of all mouldings are referred to a section at right angles to their longitudinal direction, when prismatic, or passing through the axis, if annular; and this is simply denominated *the Section*, on account of its frequent use, as oblique sections only occur in mitres. The names of mouldings depend upon their form and situation.

Names and shapes.

If the section is a semicircle which projects from a vertical diameter, the moulding is called an Astragal, Bead, or Torus; if a torus and bead be both employed in the same order of architecture, they are only distinguished by the bead being the smallest. The tori are generally employed in bases, but the bead both in bases and capitals.

If the moulding be convex, and its section be the quarter of a circle or less, and if the one extremity project beyond the other equal to its height, and the projecting side be more remote from the eye than the other, it is termed a Quarter Round; this, in Roman architecture, is always employed above the level of the eye.

If the section of a moulding be concave, but in all other respects the same as the last, it is denominated a Cavetto. They are never employed in bases or capitals, but frequently in entablatures.

Names and shapes of mouldings.

If the section of a moulding is partly concave and partly straight, and if the straight part be vertical and a tangent to the concave part, and if the concavity be equal or less than the quadrant of a circle, the moulding is denominated an Apophyge, Scape, Spring, or Conge: it is used in the Ionic and Corinthian orders for joining the bottom of the shaft to the base, as well as to connect the top of the fillet to the shaft under the astragal.

If the section be one part concave and the other convex, and so joined that they may have the same tangent, the moulding is named a Cymatium; but Vitruvius calls all crowning or upper members cymatiums, whether they resemble the one now described or not.

If the upper projecting part of the cymatium be a concave, it is called a Cima-recta, they are generally the crowning members of cornices, but are seldom found in other situations.

If the upper projecting part of the cymatium be convex, it is called a cima-reversa, and is the smallest in any composition of mouldings, its office being to separate the larger members: it is seldom used as a crowning member of cornices, but is frequently employed with a small fillet over it, as the upper member of architraves, capitals, and imposts.

If the convex part of a moulding recede and meet a horizontal surface, the recess formed by the convexity and the horizontal surface is termed a Quirk.

If the section of the moulding be a convex conic section, and if the intermediate part of the curve project only a small distance from the greatest projecting extremity, and if the tangent to the curve at the receding extremity meet a horizontal line produced forward without the curve at the upper extremity, the moulding is called an Ovolo. It is generally employed above the eye, as a crowning member in the Grecian Doric. Ovolos may be used in the same composition of different sizes; it is sometimes cut into egg and tongue, or egg and dart, when it is termed Echinus. It is employed instead of a torus in the base of Lysicrates at Athens. The contour of ovolos are generally elliptical or hyperbolical curves. These curves can be regulated to any degree of quickness or flatness; the parabola can also be drawn under these conditions, but its curvature does not afford the variety of change of the other two species.

If the section be a concave semi-ellipse, having its conjugate diameter such that the one may unite the extremities of its projections, and the other diameter may be parallel to the horizon, the moulding is termed a Scotia. They are always employed below the level of the eye; their situation is between two tori. The one extremity has generally a greater projection than the other, and the greater projection is nearest to the level of the eye.

If the section of the moulding be the two sides of right angles, the one vertical, and the other of course horizontal, it is termed a *fillet, band*, or *corona*. A fillet is the smallest rectangular member in any composition of mouldings. Its altitude is generally equal to its projection; its purpose is to separate two principal members, and it is used in all situations under such circumstances. The corona is the principal member of a cornice. The beam or facia is a principal member in an architrave as to height, but its projection is not more than that of a fillet.

Rules for describin moulding

In the following descriptions, the projections and heights are always supposed to be given in position to the extremities of the curve.

Torus. Plate CLXXXII Fig. 1.

To describe the *torus*, Plate CLXXXII. Fig. 1. Let ab be the vertical diameter whence the torus projects; bisect ab in c; from c, with the radius ca or cb, describe the semicircle bda, which will be the profile of the torus.

Ovolo.

To describe the *ovolo*, the height and projection being

Plate CLXXXII. Fig. 2. No. 1. and 2.

given Fig. 2. First, let the height and the projection be equal to each other. Draw *ab* equal to the height, and *bc* at a right angle with, and equal to, *ab*, for the projection; then with the radius *ba* or *bc* describe the arc *ac*, which is the contour of the ovolo. But if the projection is not equal to the height, but less, as in Fig. 2. draw *ab* and *bc* forming a right angle as before, *ab* being made equal to the height, and *bc* equal to the projection; from the point of recess *a*, with the height *ab*, describe an arc *bd*; and from the point *c* of projection, with the same radius, describe another arc cutting the former at *d*; lastly, from *d*, with the radius *da* or *dc*, describe the arc *ac*, which is the contour required.

Cavetto. Fig. 3. 4.

The methods of describing the *cavetto*, Fig. 3. and 4. are the same as that for describing the ovolo, the one being the same as the other reversed.

Cima-recta. Fig. 5.

To describe the *cima-recta*, Fig. 5. Join the point of recess *a* to the point of projection *b* by the line *ab*; bisect *ab* in *c*, with the distance *bc* from the points *c*, *b*; describe the intersection *e*, and from the points *ac*, with the same distance, describe the intersection *d*; from *d*, with the distance *da* or *dc*, describe the arc *ac*; and from *e*, with the distance *eb* or *ec*, describe the arc *bc*; and *acb* will be the contour of the cima-recta required. If the curve is required to be made quicker, we have only to use a less radius than that of *ac* or *cb*, in order to describe the two portions of its contour.

Cima-reversa. Fig. 6.

The same description applies to the *cima-reversa*, Fig. 6. by the same letters of reference.

Apophyge. Fig. 7.

To describe the *apophyge*, Fig. 7. the projection being given. Let *ab* be the projection, and *ace* a line which it is required to touch. Make *ac* equal *ab*, and with the distance *ac* or *ab* from the points *b* and *c* describe the intersection *d*; from the point *d*, with the radius *db* or *dc*, describe the arc *bc*, which is the contour of the apophyge.

Fig. 8.

To describe the *apophyge* so as to touch a right line given in position at the point of projection, Fig. 8. Let *bc* be the right line; and *ab* the projection of the moulding; draw *acdf* at a right angle with *ab*; make *cd* equal to *cb*; draw *be* perpendicular to *bc*, and *de* perpendicular to *cd*; from the point *e* describe the arc *bd*, which is the contour of the moulding.

Scotia. Fig. 9.

To describe the *scotia*, Fig. 9. the extremities *a* and *b* of the curve being given. From the projecting point *b* erect *bde*, and from the receding point let fall *agc* perpendicular to *bc*, the horizontal of the moulding; add the half of *ac* and two-thirds of *be* into one length, which set from *b* to *d*; from the centre *d*, with the distance *db*, describe the semicircle *bfe*; draw the straight line *eaf*, and *dgf*; from the point *g*, with the distance *ga* or *gf*, describe the arc *af*: then will *afb* be the contour of the scotia required.

Greek ovolo. Fig. 10. 11.

To describe an *ovolo*, the tangent *ac* at the receding extremity *a*, and its projection at *b* being given, Fig. 10. and 11. Draw the vertical line *cbd*; draw *be* parallel to *ca*, and *ae* parallel to *cb*; produce *ae* to *f*, making *ef* equal to *ea*; divide *eb* and *bc* each into the same number of equal parts; from *f*, and through the points of division in *ab*, draw right lines; also from *a*, and through each of the divisions in *bc*, draw another system of lines, and the corresponding intersections of each pair of lines will be as many points in the curve as there are pairs; then a curve being drawn through the points, will be the greater part of the contour. The remaining part *bg* may be found in the same manner, by drawing lines from *a* through the points in *be* instead of *f*, and drawing lines from *bd* to *f*, instead of *bc* to *a*. The curve drawn in this manner is a portion of an ellipsis, something greater than the quarter of the whole. The recess of the moulding at its projecting point is denominated the quirk. Fig. 10. is adapted for entablatures; and Fig. 11. having a large projection, to capitals of Doric columns, such as may be seen in the temple of Corinth, and in the Doric portico at Athens. This method, though easy, gives the extremity of the conjugate axis, between the receding extremity *a*, and the point of projection *b*; but the following method gives the extremity of the shorter axis, where the tangent commences, at the receding extremity of the contour of the ovolo.

Plate CLXXXII. Fig. 12.

To describe the *ovolo*, supposing the extremity of the conjugate axis to be at the point of contact *a*, Fig. 12. Join *ab*, which bisect in *e*, and draw *cef*: make *aflk* perpendicular to the tangent *ac*, then the point *f* will be the centre of the ellipsis: draw *fhi* parallel to *ac*; take the distance *fa*, and from the point *b* cross the line *fi* at *h*; produce *bh* to *l*, and make *fi* equal to *bl*; then with the semi-transverse *fi*, and the semi-conjugate *fa*, describe an ellipsis, and the portion of the curve contained between the extremities *a* and *g*, will be the contour of the moulding required. This method is recommended as producing the most graceful form of an ovolo, as the lower extremity of the curve begins at the point of contact. From the large projection here given, the moulding is adapted to Doric columns.

Fig. 13.

To describe the *hyperbolical ovolo*, as used in Doric capitals, the same things being given as before, Fig. 13. Erect *adefg* perpendicular to the horizon, and draw *cd* and *be* at right angles to *adefg*: make *eg* equal to *ae*, and *ef* equal to *ad*; join *bf*, divide *bf* and *bc* into the same number of equal parts, and draw lines from g through the divisions of *bf*, also lines from *a* through the divisions of *bc*: Each corresponding pair meeting as before, will give the points in the curve of the hyperbolical moulding. This is the general form of the ovolos in the capitals of the Grecian Doric.

Fig. 14.

To describe a *scotia*, Fig 14. Join the extremities *a* and *b* of the moulding; bisect *ab* in *c*; draw *ecd* parallel to the horizon; make *cd* equal to the recess of the curve, and *ce* equal to *cd*; then with the conjugate diameters *ab* and *ed* describe the curve *adb*, which will be the contour of the moulding required.

Annulets. Fig. 15.

Fig. 15. represents the form of the annulets as applied in Fig. 13. where the receding parts are in the tangent at the bottom of the curve of the ovolo.

Fig. 16.

Fig. 16. represents another kind of annulet, which has a vertical position. This form is only to be found in the Doric portico at Athens.

Fig. 17.

Fig. 17. represents a curious Grecian moulding, to be found under coronas.

To diminish columns. Plate CLXXXIII. Fig. 1.

To diminish the shaft of a column, Plate CLXXXIII. Fig. 1. Let AB be the altitude of the column, and BC the diminution at the upper end of the shaft; divide AB into any number of equal parts, and divide the projection BC into the same number; draw the lines 1*b*, 2*d*, 3*c*, &c. at right angles to the altitude; and draw other lines from the points 1, 2, 3, &c. in BC towards A, to intersect with the former parallel lines at the respective points *b*, *c*, *d*; then A*bcdef*C, will be the curve line of the section of the column.

Fig. 2.

But suppose it were required to give less swell to the column, as in Fig. 2. Divide AB as before, and DC into two equal parts at D; divide DC into as many equal parts as AB; then proceed as in Fig. 1.. Or thus: suppose EF to be the axis of the column, EG, EA the semi-diameters at the bottom, and FN, FC the semi-diameters at the top; on AG, as a chord, describe the segment AOPG of a circle, proportionably less than a semicircle, as the swell is intended to be less; draw NP parallel to FE; divide the arc GP into any number of equal parts, and divide the altitude EF into the same number of equal parts: through the points of division draw the lines $a\,h$, $b\,i$, $c\,k$, $d\,l$, $e\,m$, parallel to AG; also draw G $1h$, $2i$, $3k$, $4l$, $5m$, PN, perpendicular to A; then through the points G, h, i, k, l, m, N, draw a curve, which will be the contour required.

Flutings. PLATE CLXXXIII. Fig. 3.

To describe the flutes of a column without fillets, Fig. 3. Let AB, No. 1. be the diameter, which bisect in G; draw AD and BC perpendicular to AB, and describe the semicircle AEFB; draw DC to touch the circle, and DEG and CFG to the centre G; divide the arc EF into five equal parts, and run the same part on the arcs EA and FB, so that the whole will be divided into nine equal parts, and two half parts at each extremity; then the points of division will mark the arris of the flutes. Their concavity will be found by an arc described from the summit of an equilateral triangle. The fluting at the upper end of the shaft, shown in the concentric circle, is described in the same manner. No. 2. represents the bottom elevation, and No. 3. the top elevation of the shaft, as drawn from the section.

No. 2. No. 3.

Fig. 4.

To describe flutes with fillets on the shaft of a column, Fig. 4. Supposing every thing is done as in Fig. 3. before the division of the circle. Divide EF into six equal parts, and run the chord upon the arcs EA and FB, each of which will contain it three times, so that the whole semicircumference will be divided into twelve equal parts, the points of division marking the centres of the flutes: divide the chord of one of these small arcs into five equal parts; then with three of these parts as a radius, from each of the aforesaid centres describe a semicircle, which will be that representing the section of the flute. Those of the interior circle representing the top of the shaft, are found by drawing the lines to the centre, as appears sufficiently by the figure. No. 2. the elevation of the fluting at the bottom of the shaft, as in the temple of Vesta at Rome. No. 3. the elevation of the fluting, as in the temple of Bacchus at Teos. No. 4. and 5. the common way in which the flutings of columns are terminated at the bottom and top of the shaft.

No. 2. No. 3. No. 4. 5.

Of the Doric Order.

Doric order. PLATE CLVIII.

This is the most ancient of the three orders, (see Plate CLVIII.) and, while employed by the Greeks, was without a base; the surface of its shaft is usually found worked into twenty very flat flutes, meeting each other at an edge, which is sometimes a little rounded; the upper member of the capital is a square abacus or thin plinth, under which is a large and elegantly formed ovolo, with a great projection; immediately under the ovolo, there are three fillets or annulets which project from the continued line of the under part of the ovolo, and have equally recessed spaces betwixt them; the flutings of the column are terminated by the under side of the last of these fillets, and either partly or entirely in a plain surface at right angles with the axis of the column.

Detailed description. Shaft and capital.

Architrave.

The architrave is composed of one vertical face, with a band or fillet at its upper edge; to the under side of this band are suspended a small fillet and conical drops or guttæ, which, for their position, are dependent upon the ordnance of the frieze.

Frieze.

The frieze consists of rectangular projections and recesses placed alternately. The height of each projection or tablet is rather more than its breadth. The recesses are either perfectly or nearly square. The tablets are each cut vertically into two angular channels, with two half ones on the extreme edges; each channel is formed by two planes meeting at its bottom at a right angle, and each forming an angle of 135 degrees with the face of the tablet. The upper ends of the channels are terminated in various forms; the tablets are, from their channellings named Triglyphs; in a direction immediately under each triglyph, and equal to its breadth, a small fillet is attached to the lower side of the architrave crowning band, and from it depend six guttæ or drops, which are generally the frusta of cones with their bases downwards, though they are sometimes of a cylindrical shape. The square spaces in the frieze between the triglyphs, are named Metopes, and are frequently decorated with sculptures.

Cornice.

The cornice is strongly marked by a corona of great projection, forming a very distinct separation between its upper and lower parts; and by having, below the corona, and immediately over the triglyphs, blocks named Mutules, which also project considerably, and have the plane of their soffits with an inclination from their roots towards the horizon, and these have likewise guttæ or drops depending from their soffits.

That the proportion which the different members of the Doric order bore to each other were practised by the Greeks with considerable latitude, will be evident from the following Tables, which exhibit the dimensions of the principal parts of this order in all the ancient Greek edifices which have been examined with accuracy. The dimensions here put down are in feet, inches, and decimal parts.

Proportion of principal members.

Shafts and capitals.

Names of Edifices.	Dimensions of Columns.							
	Of the Shaft.						Capital.	
	Heights.		Diameters.				Heights.	
			Bottom.		Top.			
	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
Temple of Jupiter Panellenius at Ægina, . . .	15	9.55	3	2.6	2	4.65	1	6.7
Temple of Ægina, ...	17	4.25	3	2.6	2	4.65	1	6.7
Temple of Theseus, ...	18	8.6	3	3.65	2	6.63	1	7.9
Portico of Philip King of Macedon, ...	19	4.0	2	11.5	2	5.3	1	0.6
Temple of Minerva at Sunium, ...	19	9.150	3	4.2	2	6.65	1	2.966
Hexastyle temple at Pæstum, ...	20	4.25	4	2.93	3	0.52	2	4.75
Enneastyle temple at do.	21	0.0	4	9.75	3	2.0	2	4.83
Temple of Juno Lucina at Agrigentum, . . .	21	2.0	4	6.1	3	4.875	. . .	
Temple of Concord at do.	22	0.75	4	7.7	3	6.75	2	3.125
Temple of Corinth, ...	23	8.575	5	10.0	4	4.1	2	4.375
Doric portico at Athens, ...	26	2.5	4	4.05	3	4.6	. . .	
Temple of Minerva at Syracuse, peristyle, . .	28	8.0	6	6.04	5	0.5	3	5.325
Lesser hexastyle temple at Silenus, ...	. . . . .		6	6.9	4	1.9	. . .	
Propylea at Athens, ...	28	9.85	. . .		3	11.0	2	6.65
Hypethral temple at Pæstum, ...	28	11.42	7	0.03	4	9.8	3	10.17
Temple of Minerva at Syracuse, Pronaos, . . .	31	0.75	6	9.3	5	2.0	3	3.5
Greater hexastyle temple at Silenus, ...	32	8.13	7	5.9	5	0.2	3	8.08
Temple of Jupiter Nemeus, ...	33	11.2	5	2.5	4	3.0	. . .	
Parthenon at Athens, ...	34	2.8	6	1.8	4	9.75	2	9.9
Octostyle hypethral temple at Silenus, ...	48	7.0	10	7.5	6	3.6	4	9.5
Temple of Jupiter Olympus at Agrigentum, .	*	*	*	*	9	11.5	8	2.5

Entablatures.

Names of Edifices.	Heights of Entablature.					
	Architrave.		Frieze.		Cornice.	
	Ft.	In.	Ft.	In.	Ft.	In.
Temple of Jupiter Panellenius at Ægina, . . .	2	9.05	2	9.1	. . .	
Temple of Ægina, ...	2	9.05	2	9.1	1	3.9
Temple of Theseus, ...	2	8.9	2	8.55	1	0.45
Portico of Philip King of Macedon, ...	1	10.7	2	4.9	1	2.8
Temple of Sunium, ...	2	8.45	2	8.45	1	0.6
Hexastyle temple at Pæstum, ...	3	2.625	3	2.0	1	9.0
Enneastyle temple at do.	3	9.75	3	4.0	*	*
Temple of Juno Lucina at Agrigentum, . . .	4	1.75	3	4.25	*	*
Temple of Concord at do.	3	7.375	3	6.95	1	11.25
Temple of Corinth, ...	4	8.75	*	*	*	*
Doric Portico at Athens, ...	2	10.6	3	0.7	1	6.45
Propylea at Athens, ...	3	9.0	3	9.85	. . .	
Hypethral temple of Pæstum, ...	4	11.25	4	8.8	2	6.0
Parthenon at Athens, ...	4	5.1	4	5.05	3	3.8
Temple of Jupiter Olympus at Agrigentum, .	10	4.18	10	2.5	*	*

Observations upon the above Tables.

In the temples of Jupiter Panellenius at Ægina, Theseus at Athens, Minerva at Sunium, Jupiter Nemeus between Argos and Corinth, the cornice has lost the ovolo or crowning member, the dimensions in the table are therefore taken without it; the temple of Minerva Parthenon at Athens is the only ancient Greek edifice in which this member exists, and in this instance the lower extremity is recessed within the fillet which is immediately under it. Those parts marked with a star in the table are totally gone. The crowning member of the cornice of the portico of Philip King of Macedon is a cima recta, having its lower extremity also recessed within the fillet which is below it. The cornice of the hexastyle temple of Pæstum is crowned with a cavetto. Being a singular circumstance in the Greek Doric, it leads to a suspicion that it may have been added in some subsequent repair.

From consulting these Tables, it will be seen, that in the best examples, the height of the architrave and frieze are nearly equal; in the temple of Sunium they are precisely so. The only exception of consequence is in the temple of Juno Lucina at Agrigentum, where the architrave exceeds the frieze 9½ inches: in no other instance is the difference at all material, and any that does exist has most probably arisen from the impracticability of procuring so many marbles of the same dimensions. In comparing the tabular dimensions, it is to be observed, that the band or capital of the triglyph is included in the height of that member. This, in Stuart's *Athens* and the *Ionian Antiquities*, projects only in front, but never returns upon the flanks but at the external angle of the edifice. With the exception of the Doric portico and the temple of Jupiter Nemeus, where the heads of the glyphs are terminated by planes parallel with the horizon, the middle part of the beads, in all the purest examples, is a horizontal plane, and the surface of the sides cylindrical, so as to form a tangent with the intermediate plane, and likewise the arc on the face a tangent with the intersection of each vertical plane of the glyph. Each semiglyph is terminated by two semi-cylindrical surfaces, the axis of each cylinder being perpendicular to each return of the glyph, and thereby forming a semi-cylindric groin, and a pendent with each angle above the semiglyph. The general height of the epistyle or architrave is equal to the superior diameter of the column, though in some cases a little more or less; the height of the zophorus or frieze is equal to that of the epistyle; the mean breadth of the triglyph tablet is equal to half the inferior diameter of the column; the mean height of the cornice is half the diameter; so that the architrave, frieze, and cornice, are respectively to each other as the numbers 3, 3, and 2. If the whole entablature is divided into 8, the breadth of the triglyph is two of these parts.

In all examples of this order, except the temple of Apollo at Delos, the hexastyle temple at Pæstum, the portico of Philip king of Macedon, and the Doric portico at Athens, the face of the triglyph tablet, and that of the epistyle or architrave, are in one vertical plane; so that the fillet named regula, and the gutta under the cup of the epistyle, being regulated by the breadth of the triglyph, will, at each external angle, only touch at their internal points, and leave a void space at the external angle of the epistyle cups. This is exemplified in the temples of Minerva, Theseus, and the propylea at Athens; the temple of Minerva at Sunium; Jupiter Nemeus, Jupiter Pannellenius, Minerva at Syracuse; Concord at Agrigentum; the hypethral temple at Pæstum, and also of Silenus and Jupiter at the same place. And where the face of the epistyle, and that of the triglyph tablet, are in one vertical plane, the guttæ will be six in number under each regula, at every external angle or return, that is, making twelve on the two sides. In the Doric portico at Athens, the temple of Apollo at Delos, and the hexastyle temple at Pæstum, the face of the metopes and that of the epistyle are in one vertical plane. The triglyphs, regula, and guttæ, project from the plane of the epistyle, and at the returns meet at the external angles; and though the guttæ appear six on each face, yet the guttæ at the angle being common to both faces, the whole make only eleven.

In the cornice, the corona forms the most prominent feature in the temple of Concord at Agrigentum, and of Jupiter at Silenus. Instead of having the crowning ovolo, the cornice terminates with a face receding within the corona. This is so contrary to usual practice and propriety, that we are led to suspect, that a defect in the stones, which formed the upper division of the cornice, may have been supplied by having an ovolo fixed in this recess. In every specimen of pure Doric, the cornice has mutules. In examples to be found in Sicily, the drops from the soffit of the mutules, are cylinders of greater height than diameter; but in all the best examples, they are not more than half their diameter in height, and in some instances considerably less. In the temple of Theseus, the drops are frustums of cones; but, in the same specimens, those under the regula upon the epistyle have both a concave and convex flexure.

The hexastyle temple at Pæstum, instead of mutules, has the soffit formed into coffers; but, in this specimen, it is only the capital and triglyphs which bear any affinity to the Greek Doric; and even on the capital, in place of annulets, there is a row of delicate leaves crushed together between two astragals; and the triglyph being placed at the returning angle, they are over the centre of the columns; so that this specimen partakes more of the degenerate Roman than the pure Greek.

Having investigated what relates to the primary and secondary divisions of this order, and also noted the positions and relative proportions of the leading features, we shall add a farther statement respecting its columns, founded upon Table I. In this additional Table, the diameter at the base is considered the same in all, viz. unity. The whole numbers represent diameters. The figures to the right hand of the point are decimal parts of the diameter. The examples are arranged increasing in altitude.

Statement respecting Doric columns.

Names of Edifices.	Diameters.	Top of Shaft.
Temple of Corinth	4.065	.73
Hypethral temple at Pæstum	4.134	.687
Enneastyle do. do.	4.329	.661
Greater hexastyle do. at Selinus	4.361	.769
Temple of Minerva at Syracuse	4.410	.762
Octostyle hypethral temple at Selinus	4.572	.592
Temple of Juno Lucina at Agrigentum	4.605	.755
Temple of Concord at Agrigentum	4.753	.767
Hexastyle temple at Pæstum	4.795	.717
Temple of Jupiter Pannellenius	5.397	.742
Temple of Minerva at Athens	5.566	.782
Temple of Theseus do.	5.669	.772
Temple of Minerva at Sunium	5.899	.762
Temple of Apollo in the island of Delos	5.931	.754
Doric portico at Athens	6.042	.780
Temple of Jupiter Nemeus	6.515	.816
Portico of Philip, king of Macedon	6.535	.825

Observations upon the Table.

From this Table it is evident, that the ancients did not scrupulously adhere to any precise proportions in their columns for different edifices; but not knowing the dates of the construction of the several specimens, we are unable to determine whether these differences existed at the same time, or succeeded each other in consequence of a change of taste. It may also be observed, that, of seventeen examples, the upper diameters of six are less than three-fourths, and eleven greater. The diminution of the superior diameter in the temple of Theseus is .772, which is something less than a mean between three-fourths and four-fifths: the half sum of these fractions being .775. This example of the temple of Theseus is one of the best of the Greek Doric, and may be taken as a rule; or in practice, to make the superior diameter three-fourths of the inferior, is still more simple, and sufficiently correct.

In every Greek Doric, the vertical face of the epistyle or architrave projects beyond the superior diameter, but is within the inferior one.

In the temple of Theseus, the height of the abacus is nearly one-fifth of the diameter, and the ovolo and annulets together are very nearly equal to the abacus. The height of the annulets is very nearly one-fifth of the ovolo. The horizontal dimension of the abacus extends, on each side, very nearly six times its height. The neck of the capital is nearly half the height of the annulets. In the temple of Corinth, and the Doric portico at Athens, the ovolo or echinus is of an elliptical shape; but in every other instance of Greek capitals, it is hyperbolical, excepting the single instance of the portico of Philip, king of Macedon.

Proportions established.

From the preceding dimensions and observations, we establish the following proportions for the construction of the Doric order: Considering the diameter that of a circle, at the lower end of a shaft the column is six diameters in height. The thickness of the upper end of the shaft is three-fourths of the lower, or it diminishes one-fourth of the diameter. The height of the capital is half a diameter. That of the ovolo, with the annulets, and that of the abacus, are each one-quarter of the upper diameter. The annulets are one-fifth of one of the parts. The horizontal dimension of each face of the abacus is six times its height. The entablature is divided into four equal parts; the upper one is the height of the cornice; the remaining are divided equally between the architrave and frieze. The inner edge of the angular triglyph is placed in a vertical line with the axis of the column. The height of the triglyph is divided into five equal parts; three of these parts give the distance of its returning face, and determine also that of the epistyle, and consequently include the breadth of the triglyph. The height of the capital of the triglyph is one-seventh of its whole height, and the capital of the metope one-ninth. The breadth of the triglyph is divided into nine equal parts, giving two to each glyph, one to each semi-glyph, and one to each of the three inter-glyphs. The metopes are square. The height of the cornice is divided into five equal parts; the lower is given to the fillet, the mutule, and drops; the next two to the corona; and the remaining two parts are subdivided and disposed amongst the several members, in the manner shewn in Plate CLVIII. The projection of the cornice is equal to its height; it is divided into four equal parts, giving three to the projection of the corona. The subdivisions in the Plate shew the profiles of the smaller members. In this example, the column is taken from the temple of Theseus, and the entablature from that of Minerva at Athens.

Plate CLVIII.

The number of annulets in the capital vary from three to five; and the number of horizontal grooves, which separate the shaft from the capital, vary from one to three.

In the application of the Doric order to temples, the shafts of the columns are generally placed upon three steps, which are not proportioned like these in a common stair, but to the magnitude of the edifice.

The preceding specimens have all been taken from Greek edifices, these being considered the only pure style of this fine order. The best example of Roman practice is that taken from the theatre of Marcellus, by Sir W. Chambers, to whose excellent work on civil architecture we refer our readers.

Ionic order.

Of the Ionic Order.

General remarks.

Although, in the Ionic, the primary division, into columns and entablature, and the secondary, of shaft, capital, architrave, frieze, and cornice, remained the same, yet the omission of some of the principal subdivisions of those parts, and the introduction of others entirely new, as well as the greater degree of delicacy in all, distinguishes this sufficiently from the Doric order, and establishes its claim as a distinct order or canon of Greek architecture. See Plate CLIX.

Plate CLIX.

The Ionian Greeks having become wealthy, and being, no doubt, influenced by the manners of their Asiatic neighbours, refined upon the simplicity of attic architecture, and invented a capital totally different from that employed in the mother country. Its origin is, however, problematical. Vitruvius reports it to have been made in representation of the curls in the head-dress of females; but other hints are quite as probable, as the spiral shape of the horns of rams, used in their sacrifices; or that assumed by the barks of some trees, when dried in the sun; or that of certain delicate vegetables, such as the slender fern, before it is quite unfolded; or the beautiful spiral forms of various sea-shells, any of which are sufficient to guide the fancy of an ingenious artist in composing the volutes of the capital of Ionia.

Origin of capital.

Architrave, frieze.

Cornice.

In the architrave and frieze, all appearances of triglyphs and guttæ are omitted; and in the cornice, instead of the bold mutules of the Doric, the ends of smaller pieces of wood, to which the covering tiles were fixed, are represented by what are termed dentils or teeth. This order also differed from the Doric, by having a base at the lower extremity of the shaft; the propriety of this might have arisen from the diameter of the shaft being much less than that of the Doric, in proportion to the height of the order, or the weight it had to sustain.

Base.

The rest of the Ionic order is not so precisely defined, or so uniformly adhered to, as similar parts in the Doric. The Temple of the Muses, on the Ilyssus, is composed of few, but very distinct and bold parts. The height of the volutes is three-fifths, and that of the whole capital two-thirds of the diameter of the shaft. If the entablature is divided into five parts, two are occupied by the architrave, which consists of a single facia, crowned with a cymatium; the remaining three are divided into five other parts, three of which are occupied by the plain part of the frieze, and the remaining two by the cornice. The cymatium of the frieze, which consists of a cima-reversa standing upon a bead, is worked out of the cornice. The cornice, as viewed in front, is composed of a corona, cymatium, and cima.

Temple of the Muses.

In the temple of Erectheus and Minerva Poliss at Athens, the architrave has three faciæ and a cymatium, and the cymatium of the frieze is worked chiefly out of the cornice. The height of the entablature, from the bottom of the lower facia of the architrave to the top of the cymatium upon the corona, if divided into nineteen parts, the architrave and frieze will each have eight, and the corona, larima, and cymatium will occupy the remaining three parts. In these specimens, the volutes have a singular degree of symmetry and beauty.

Minerva Polias.

In all the Greek Ionics, the height of the cornice, measured from the lower edge of the corona upwards, appears to have a constant ratio to the total height of the entablature, viz. nearly as 2 to 5, which seems the true one to accord with the character of the order. The great recess of the mouldings, under the corona, gives it a striking prominence, and prevents the cornice from appearing too heavy, though both the dentil band and cymatium of the frieze are introduced under it.

Cornice.

On account of the frieze being wanting in most of the Asiatic remains, although the architrave and cornice have been accurately measured, the height of the entablature cannot be ascertained. The only instance in which a frieze has been discovered is in the theatre of Laodicea; and there it is rather less than one-fifth of the entabla-

Frieze.

ture. In the temple of Bacchus at Teos, and Minerva Polias at Priene, the architraves are divided into three faciæ below the cymatium. Their proportions are very different from those at Athens, though also elegant in character and effect.

Cornice.

In all the Asiatic Ionics, the crowning mouldings of the cornices are cima-recta, less in projection than height. The dentil bands are never omitted, and their height is a mean between that of the cima-recta and of the larima, corona, or drip, being uniformly greater than that of the corona, and less than that of the cima-recta. The cymatium of the denticulated band is recessed upwards, being almost entirely wrought out of the soffit of the corona, which nearly conceals its height. The height of the cornice, from the top of the cima to the lower edge of the dentils, is equal, or nearly so, to that of the architrave. The height of the frieze, without its cymatium, may be about one-fourth of the whole entablature.

Column.

We have observed that the height of the Ionic column was originally eight diameters; the moderns have increased it to nine. The shaft is generally cut into 24 flutes, with as many fillets. The altitude of the entablature may, in general, be two diameters; but it may be increased, and should not be less than one-fourth of the height of the column in works of magnificence.

Base.

Temple on Ilyssus.

Attic base.

Temple of Bacchus at Teos.

The base of the Athenian Ionics consists of two tori, having a scotia or trochilus between them, separated from the tori, above and below, by two fillets; the fillet above the inferior torus projects, in general, as far as the extremity of the superior torus, and the fillet beneath the upper torus projects beyond both. The scotia is very flat, its section forming an elliptic curve, which joins the fillet on either side. The tori and scotia are nearly of equal altitudes. In the temple on the Ilyssus, there is a bead and fillet on the upper torus, joining the fillet to the scape of the column; in the same temple, as well as in that of Erectheus, the upper torus of the base is fluted; but the lower part, which joins the upper surface of the fillet above the scotia, is left entire. In the latter temple the lower torus of the base of the Antæ is receded; and in that of Minerva Polias it is fluted, each flute being separated from those on either side by two small cylindric mouldings of a quandrantal section, joining at their convexities. The upper scotia of the temple of Minerva Polias is also enriched with a guilloche. Vitruvius has, very properly, termed this the ATTIC BASE, it having been employed by the Athenians in all their Ionics; and, although the Ionians had another, more particularly appropriated to this order, they sometimes employed the Attic, as in the temple of Bacchus at Teos. In the temple of Minerva Polias at Priene, and that of Apollo Didymæus near Miletus, the bases consist of a large torus, three pair of astragals, and two scotiæ, inverted towards each other; the upper pair of astragals is below the torus, and the scotia intervenes between each pair. In the former of these temples, an additional astragal separates the torus from the shaft. The torus is elliptical with its under part fluted; there is likewise a flute in the upper part of the base. In the temple of Apollo Didymæus, the upper torus is semicircular, and each bead of every pair is separated by a narrow fillet. This base differs but little from that assigned to this order by Vitruvius, only in the former the scotiæ are inverted, and present a greater variety of profile.

Volute.

Minerva Polias.

Bacchus at Teos.

The volute, which is the great distinguishing feature of this order, in the Athenian Ionics, and the temple of Minerva Polias at Priene, the lower edge of the channel which runs between them is formed into a curve, bending downwards in the middle, and revolving about the spirals on either side. In the temple of Erectheus, and Minerva Polias at Athens, each volute has two channels formed by two distinct spiral borders; the borders forming the exterior volute, and the under side of the lower channel, have between them a deep recess or spiral groove, which diminishes gradually in breadth, till it loses itself in the centre of the eye. In the temple of Bacchus at Teos, the great theatre of Laodicea, and in all the Roman Ionics, the channel whereby the two volutes are connected has no border on the lower edge, but terminates with a horizontal line, falling in a tangent to the commencement of the second revolution of each volute.

In the temple of Erectheus, the column terminates with a fillet and astragal a little below the eye of the volute; and in the temple of Minerva Polias, it is terminated with a single fillet. In both instances, the colerino or neck is decorated with honey suckles. The upper annular moulding of the column is of a semicircular section with a guilloche.

Both Greek and Roman.

The capitals of both Greek and Roman Ionics have the eschinus, astragal, and fillet; the eschinus is always cut into eggs, surrounded with borders of angular sections with tongues between them; the astragal consists of a row of beads, having two small ones inserted between every two large ones. In all the Roman buildings, except the Coliseum, these mouldings are cut in the same manner.

Angular capitals.

Greek and Roman.

When Ionic columns stand in the flanks as well as the fronts of a building, two volutes at the corner of each angular column is contrived to present the same form in the flank as in the front, as in the temple of Bacchus at Teos, of Minerva at Priene, Erectheus, and that of the Muses at Athens, and likewise of Fortuna Virilis at Rome: the angular capitals have, in all these instances, one volute on each side, projected in a curve towards the angle. Amongst the ancient Romans, as at the temple of Concord at Rome, the capitals of all the columns are made to face the four sides of the abacus; and it was from this specimen that Scammozzi, encouraged by the example of Michael Angelo, composed the capital upon this principle, which bears his name.

Examples.

The following examples will shew the number of flutes and their form in the temples of the Ilyssus. Erectheus and Minerva Polias at Athens, Bacchus at Teos, Minerva Polias at Priene, and Apollo at Didymæus, near Miletus;—each column has 24 flutes, and as many fillets. The columns of the aqueduct of Adrian, the Ionic colonnade near the Lantern of Demosthenes, and the great theatre at Laodicea, also at the temple of Concord, the second order of the Coliseum, and the theatre of Marcellus at Rome, have their shafts plain; but the columns of the temple of Fortune, at the same place, have 24 flutes. The section of the flutes of the columns, in the temple on the Ilyssus at Athens, is elliptical; the flutes descend and follow the curve of the scape of the column in the following specimens, viz. the temple of Minerva Polias, and of Erectheus at Athens, the temple of Bacchus at Teos, and Minerva Polias at Priene.

Method of describing the Ionic Volute.

Rules to describe the Ionic volute.

PLATE CLXXXIV. Fig. 1.

To describe the Ionic volute with any number of revolutions or quarters to any given height, and to touch a circle of a given radius within the spiral.

Let AB, Plate CLXXXIV. Fig. 1. No. 1. be the height of the volute. Divide AB into two equal parts at C. From AB cut off AD, equal to the radius of the eye. Divide DC into as many equal parts as the volute is to consist of quadrants, (which, in this example, are 12,) at the points 1, 2, 3, &c. Draw CE, at any angle with AB, equal to two of these parts: draw 11 f perpendicular to CD, equal to CE: draw fg perpendicular to 11 f, equal to 11 Q: draw gh perpendicular to gf, equal to 10 P. Proceed in this manner until all the sides of the spiral fret are drawn. Produce 11 f to 1, fg to 2, gh to 3, and so on. Upon the centre at 11, with the distance d B, describe the arc B 1; from the centre f, with the distance f 1, describe the arc = 1, 2; from g, with the distance g 2, describe the arc 2, 3. Proceed in the same manner with all the remaining arcs, the last terminating at 12. Then, from the centre r, with the radius r 12, describe a circle for the eye of the volute; and the radius, r 12, of this circle will be equal to AD as required, provided the operation be accurately performed.

Plate CLXXXIV. Fig. 1. No. 2.

After the same manner may the inner spiral be drawn. Fig. 1. No. 2. shows the construction of the centres to a larger scale, and by a method not so liable to inaccuracy, as follows: Having made df equal to CE, divide it into halves at e; draw er perpendicular to df, equal to ed or ef, and draw $dinr$, and $fkor$. Make es, st, tr, equal each to G 2 on the scale: draw isk, nto parallel to df; make fg perpendicular to df, equal to 11 Q: draw the diagonal glp parallel to $dinr$: draw kl, op, nm, ih, perpendicular to df: draw gh parallel to 11 f: draw the diagonal hmq: draw lm and pq parallel to fd, and d, f, g, h, q, c, will be the centres. This method is not so liable to error, as taking the parts successively from the scale, and applying them to the spiral fret in the same order.

In order to show the truth of this universal method, we shall subjoin the following demonstration, which, it is hoped, will be satisfactory to the reader.

Let x represent any of the equal parts of which DC consists, and r the radius of the eye.

Then will $d\mathrm{B}=d\,1=\mathrm{CB}+x=$ the radius of the first quadrant, and $d\mathrm{A}=f\,1=\mathrm{CB}-x$ the radius of the second quadrant; therefore, $df=d\,1-f\,1=(\mathrm{CB}+x)-(\mathrm{CB}-x)=2x$, the first side of the fret; and CE will also be equal to twice x, as by the construction; likewise, let n be equal to the number of parts in CD; then will 1 F, the first parallel distance on the scale, be equal to $\frac{2x}{n}$; and the second $2\,\mathrm{G}=\frac{4x}{n}$; the third $3\,\mathrm{H}=\frac{6x}{n}$; but if the half sum of the extreme terms of this arithmetical progression be multiplied by their number, the product will be equal to the sum of the series. Now, the first term is $\frac{2x}{n}$, and the last term $=2x$; therefore, $\left(x+\frac{x}{n}\right)\times n=nx+x=\mathrm{DC}+x$, is the sum of the series; but $\mathrm{DC}+x$ is $=\mathrm{CA}+x-r=\mathrm{CB}+x-r$, equal to the length of the spiral fret. Now, let this last quantity be taken from $\mathrm{CB}+x$, the radius of the greatest quadrant, and there will remain r the radius of the eye as ought to be; for the difference of the radii of any two adjoining quadrants is equal to the side of the spiral fret between their centres, or, in other words, in the straight line passing through their centres, and the junction of their arcs.

Former methods imperfect.

The methods hitherto discovered for the description of volutes, are extremely imperfect and limited to three revolutions, and the eye to a certain portion of the height of the spiral. The method shown by Palladio, said, by Sir William Chambers, to be that of De l'Orme's, is imperfect, as the two adjoining arcs of any two revolutions cannot have the same tangent at their junction; and the straight line, which is a tangent to any two arcs, can only have one point of contact in the same revolution; but though this imperfection is remedied in Goldman's, yet, in the latter, the successive distances, on the lines of junction between two adjoining revolutions of the spiral, are very unequal, as the distances of the adjoining revolutions in the two upper quadrants are nearly equal, whereas, in the two lower quadrants, the distances between the adjoining revolutions of the same spiral decrease very unequally towards the centre; and this irregularity is extremely unpleasant to the eye.

But though the method we have shown is the most perfect and easy of any yet published, and has also the advantage of being universal in its application, it is far from being perfect, as it cannot be applied where the volute consists of many spirals, as in the Ionic order of the temple of Erectheus at Athens, and much less any of the other two which preceded it. There is one resource, however, by which this evil can be remedied, and by which perfection alone can be obtained, and this by the principles of the logarithmic spiral; for, in all other methods, the fillets and the intervals of the volute are never in continued geometrical proportion.

Though the principles of this curve has been long known, it is singular that its application to the Ionic volute has never been hinted at by any author, before the publication of the Principles of Architecture by Mr Peter Nicholson.

The following method of describing the Ionic volute, upon the principles of the logarithmic spiral, by means of a proportional compass, is not so liable to error, and is much more expeditious in practice, than a scale formed by the progression of the corresponding sides of a series of similar triangles, as shown in the second volume of that work.

Plate CLXXXIV. Fig. 2. No. 1.

Fig. 2. No. 1. To describe the Ionic volute similar to that in the temple of Erectheus, by the principles of the logarithmic spiral, the centre O, the cathetus OA, and the distance AI, between the first and second revolutions of the outer spiral, being given.

To describe the volute.

Produce AO to E, and draw GOC at right angles to AOE; bisect the angles AOC and COE by the right lines BOF and DOH, and the angles EOG and GOA will also be bisected. Find a mean proportional between OA and OI, and make OE equal to it; find also a mean proportional between OA and OE, and make OC equal to this mean; likewise find a mean proportional between OA and OC, and make OB equal to this last mean. Set the proportional compass, so that the distances between the two pair of points will have the same ratio to each other, as OA to OB; then opening the distance between the widest pair of points from O to A, and turning the compass to the narrowest pair; make OB equal to that distance. Again, taking OB with the widest end, make OC equal to the distance of the narrowest end. Proceed in this manner, by alternately taking the length of the last radius found between the widest points, and applying the distance between the narrowest points from the centre upon the succeeding line as a radius, until the last radius approach the eye, then through all the points draw a curve, which will be one of the spirals. In the same manner, and at the same setting of the compass, each of the inner spirals are to be drawn as the spiral *abcdefghi*.

Another method. Fig. 2. No. 2.

Another method of doing this, without marking the drawing, is to make a scale AB, with the proportional compass in the same manner as marking the distances from the centre, viz. having set the proportional com-

Fig. 2.
No. 2.

pass as before, make OA, No. 2, equal to OA, No. 1; and make Ob equal to the distance of the shorter ends. Take Ob with the longer ends, and mark the distance Oc with the shorter ends. Again, take Oc with the longer ends, and mark Od with the shorter ends. Proceed in this manner through the whole eight points, which are the number in a revolution. Draw OB of any length, making any angle with OA; draw AB, bB, cB, dB, &c. Take the successive distances OA, Ob, Oc, Od, &c. upon the edge of an ivory rule or straight slip of paper, and apply them in No. 1. from O to A, from O to B, from O to C, &c. to I, marking the points A, B, C, D, &c. In No. 2, draw iE parallel to OB, cutting AB at E; draw EF parallel to AO, cutting iB at G; draw GH parallel to OB, cutting OB at H; and draw HI parallel to AO. Then EF will be a scale to set off the second revolution in the same manner as the first; and in like manner HI will be a scale for the third revolution. By this means, and from the same scale, the whole number of intermediate spirals may be drawn without pricking the paper, marking the points with a sharp pencil instead of a steel point.

Proportional spiral.
PLATE CLXXXIV.
Fig. 3.

To describe the proportional spiral with a compass, the same data being given as before, Fig. 3.

Let the point C be ascertained as before. Join ABC, which bisect by a perpendicular BD; make BD equal to BA or BC; draw DA and DHC, and the diagonal DOF; at right angles thereto draw HOJ. Draw HFE parallel to AD, FJG parallel to DHC; proceed towards the centre with every succeeding point in the same manner; and D, H, F, J, &c. will be the centres. From D, with the distance DA, describe the quadrantal arc AC; from H, with the distance HC, describe the quadrantal arc CE; from H, with the distance HE, describe the quadrantal arc EG; proceed in this manner until as many quadrants are described as that the last will meet the eye of the volute, and this will complete one of the spirals. Suppose again it were required to draw another of the interior spirals through the point M in the cathetus OA; draw MN parallel to AC, cutting OC at N, then N will be the next point in the quadrant; proceed to find all the succeeding quadrants of this spiral as before, and thus the volute may be completed.

General proportions of the Ionic order.
PLATE CLIX.
Fig. 1.

The general proportions of the Ionic order for practice, is as follows. Fig. 1. Divide the whole height into twenty-one equal parts; give four to the height of the entablature. Divide the height of the entablature, Fig. 2. into three equal parts; make the cornice, frieze, and architrave, each one part: divide the height of the architrave into four equal parts; give one to the mouldings of the upper part or capital: divide the capital of the architrave into nine equal parts; give one to the upper fillet, three to the cavetto, four to the ovolo, and one to the bead: divide the height of the frieze into six equal parts; and give the upper one to its capital: divide the height of the cornice into three equal parts; divide the upper part into six parts, give one to the upper fillet, four to the cima-recta, and one to the lower fillet, and turn one downwards for the ovolo under; divide the lower third of the cornice into six equal parts, and dispose of the parts as appears by the scale. The height of the base, including the plinth, is half the diameter; the parts are proportioned in height as appears by the scale. The whole height of the capital is three-fourths of the upper diameter; the height of the volute 7-12ths of the lower diameter. Dividing the height of the volute into three equal parts; the top of the lower one reaches to the bottom of the ovolo the second division upon the top of the festoon: the smaller members will be found by subdivision. The juttings of the members are as follows: the cornice projects equal to its height; the projections of the intermediate members will appear sufficiently clear by the horizontal scales affixed to the Plate. The general projection of the base is one-sixth of the lower diameter of the column.

The entablature is principally imitated from the elegant example of the temple of Minerva Polias at Priene, and the capital from the Ionic temple on the Ilyssus at Athens, which is one of the boldest examples, and marks the character of the order in the most decided manner.

Of the Corinthian Order.

Corinthian order.

Introduced by Scopas.

Unless we admit the account given by Vitruvius respecting the invention of the capital by Callimachus, who is said to have been an Athenian sculptor, and a contemporary of Phidias about 540 B. C. there is no certain evidence with regard to the time when this order was established. Pausanias (book viii.) says, that in the fourth century before the Christian æra, it was introduced by Scopas in the upper range of columns in the ancient temple of Minerva at Tegea; but it has been alledged, that there is a strong probability that this temple was only begun by Scopas, but being left unfinished, had this upper range added, upon the lower ancient Doric, under Roman influence. There must certainly have been some particular reason why this order was called Corinthian; but Doric remains only have been discovered on the site of that city by modern visitors.

Has an attic base.

In all the examples in Stuart's *Athens*, this order has an attic base; the upper fillet of the trochilus or scotia projects as far as the upper torus. In the monument of Lysicrates, the upper fillet of the base projects farther than the upper torus, which is an inverted ovolo.

Shaft compared with Ionic.

Vitruvius observes, that the shaft has the same proportions as the Ionic, except the difference which arose from the greater height of the capital, it being a whole diameter, whereas the Ionic is only two-thirds of it. But this column, including the base and capital, has, by the moderns, been increased to ten diameters in height. If the entablature is enriched, the shaft should be fluted. The number of flutes and fillets are generally 24; and frequently the lower one-third of the height has cables or reeds, husks, spirally twisted ribbands, or some sort of flowers inserted on them.

Capital.
PLATE CLX.

Description.

The great distinguishing feature of this order is its capital, (see Plate CLX.) which has for two thousand years been acknowledged the greatest ornament of this school of architecture. The height is one diameter of the column, to which the moderns have added one-sixth more. The body, or nucleus, is in the shape of a bell, basket, or vase, crowned with a quadrilateral abacus, with concave sides, each diagonal of which is equal to two diameters of the column. The lower part of the capital consists of two rows of leaves, eight in each row; one of the upper leaves fronting each side of the abacus. The height of each row is one-seventh, and that of the abacus one-eighth of the whole height of the capital. The space which remains between the upper leaves and the abacus is occupied by little stalks, or slender caulicolæ, which spring from between every two leaves in the upper row, and proceed to the corners, and also to the middle of the abacus, where they are formed into delicate volutes. The sides of the abacus are moulded, as in the Stoa, or portico, and arch of Adrian at Athens, and also the ruin at Salonica: the curves of the sides are continued until they meet in a sharp horn or point. In the attic capital, the small divisions of the leaves were pointed in imitation of the acanthus. In Italy they most generally resembled the olive.

Best specimens.

The best specimens are the monument of Lysicrates, the Stoa, and arch of Adrian at Athens; and the pantheon of Agrippa, and the three columns of the Campo Vaccino at Rome. In the monument of Lysicrates, the lower part of the capital consists of two rows of leaves; the lower row is plain, and the upper one raffled; and the latter is nearly twice the height of the former. The number of leaves in the upper row is eight, in the lower, sixteen. In the upper row, the sides of the middle leaf, upon each front of the capital, is covered by the flank leaves; and the whole of the leaves appear as if fastened to the body, or bell part, by a rose-headed pin, on each side of the flank leaves. Each of the helices, or stalks, proceeds from the sides of the middle leaf at the top of each row, as if they sprung from one common vertical stalk; then rising upwards, they take a direction towards the left, in a line of contrary curvature, and terminating in foliage. The volutes in the middle of the capital are quadruple, each one of each pair of one side, meeting each one of the other pair upon that side. And as each pair of volutes spring from the same trunk, and begin at the same horizontal position of the curve, each one of each pair is turned outward, and varies in size, the lesser being above, and the greater below. The four volutes form a curvilinear quadrilateral figure, by having their convex sides presented to each other. The upper or lesser pair support the honeysuckle which covers the middle part of the abacus. The corners of the abacus are cut off; and the hollow or lower member forms an inverted scotia, which is nearly four times the height of the crowning ovolo.

It may be observed generally, in the Greek Corinthian, that the volutes terminate in a point in the natural spiral, without either coiling round a circular eye, or bending backwards in a serpentine form, as in most of the Roman specimens.

This order seems never to have been much employed in Greece before the time of the Roman conquest; but this powerful people employed it almost exclusively in every part of their extensive empire; and it is accordingly in edifices constructed under their influence that the most perfect specimens are found.

We have already noticed the remark of Vitruvius, that Corinthian columns were sometimes surmounted by a Doric entablature, which, besides that it is in itself very extraordinary, is not supported by any antique example now to be found. His observation respecting the Ionic entablature over the same kind of columns is verified in a number of instances.

Arch of Adrian.

The arch of Adrian at Athens, has a cornice with dentils, a plain frieze, an architrave with two plain faciæ, and an attic base.

Temple at Jackly.

A temple at Jackly, near Mylassa, has a cornice with dentils, a swelled frieze, an architrave with three plain faciæ, and an attic base.

Salonica.

At Salonica, (the ancient Thessalonica,) a building called the Incantada, has a cornice with dentils, a swelled frieze ornamented with flutings, an architrave with three plain faciæ, and an attic base.

Vesta.

The temple of Vesta, or Tivoli, has a plain cornice, with a dentil band uncut, an ornamented frieze, an architrave with two plain faciæ, and an attic base.

Antoninus and Faustina.

At Rome, the temple of Antoninus and Faustina has a plain cornice, with the dentil band uncut, an ornamented frieze, an architrave with two faciæ divided by an astragal, and an attic base.

Portico of Septimius Severus.

The portico of Septimius Severus, in the same city, has a plain cornice, with a small uncut dentil band, a plain frieze, and an architrave with three faciæ divided by mouldings.

In all these instances, the entablature and base are similar to those generally observed in the Ionic order, from which these Corinthian examples differ only in the form of their capitals. But in those which we are now about to cite, it will appear, that the Romans attempted to give the Corinthian order a more distinct character, by appropriating to it a peculiar entablature and base, and thus making a complete order of what might be previously regarded as a composition, in which light Vitruvius seems to have considered it.

Pantheon.

The portico of the pantheon has a cornice with modillions, and an uncut dentil band, a plain frieze, an architrave with two faciæ divided by mouldings, and a Corinthian base.

Temple of Peace.

The Temple of Peace, at Rome, has a cornice with modillions and dentils, a plain frieze, and an architrave with three faciæ divided by mouldings.

Campo Vaccino.

In the Campo Vaccino, the three columns supposed by some to have belonged to a temple of Jupiter Stator, and by others to a temple dedicated to Julius Cæsar, have a cornice with modillions and dentils, a flat frieze, an architrave with three faciæ divided by mouldings, and a Corinthian base.

Jupiter Tonans.

The temple of Jupiter Tonans, at Rome, has a cornice with modillions and dentils, a flat frieze, and an architrave with three faciæ divided by mouldings.

Constantine's arch.

The arch of Constantine has a cornice with modillions and dentils, a plain frieze, an architrave with three plain faciæ, and an attic base.

Temple at Ephesus.

At Ephesus, the temple supposed by Chandler to have been erected by permission of Augustus, in honour of his uncle Julius, has a cornice with modillions and dentils, a swelled and ornamented frieze, an architrave with three faciæ divided by mouldings, and an attic base.

Nismes.

The Maison Quarré, at Nismes, has a cornice with modillions and dentils, a flat frieze, an architrave with three faciæ divided by mouldings, and an attic base.

To these we may add the following, in which the alteration seems but partially to have taken place; there being neither dentils nor dentil bands in the cornices, and the mutules, from their situation, appearing rather like a variation from the proper Ionic dentil, than a new member.

Portico at Athens.

A portico at Athens, supposed by Mr Stuart to be the ancient Pœcilè: a cornice with mutules of two square faces, an architrave with two plain faciæ, and an Attic base.

Frontispiece of Nero.

The frontispiece of Nero, at Rome: a cornice with mutules of two square faces, an ornamented frieze, and an architrave with two faciæ, divided by an ogee.

Moderns.

Palladio.

Of the modern architects who have treated of this order, Palladio makes the column 9½ diameters high, one-fifth of which he gives to the entablature, consisting of a cornice with modillions and dentils, a flat frieze, and an architrave with three faciæ, divided by astragals; the base is attic.

Scammozzi.

The design of Scammozzi bears a general resemblance to that of Palladio, but his column has ten diameters in its altitude; his entablature is one-fifth of this height; the cornice has modillions, the architrave consists of three faciæ, divided by astragals, and the base is attic.

Serlio.

Serlio, following Vitruvius, has given this order an Ionic entablature, with dentils, and the same proportion of the capital; his column is nine diameters high, and has a Corinthian base.

Vignola.

Vignola's Corinthian is a grand and beautiful composition, chiefly imitative of the

Practice.

three columns. He makes the column ten diameters and a half in height; the entablature is a fourth of that altitude, the cornice has modillions and dentils, the frieze is plain, the architrave of three faciæ divided by mouldings, and the base is attic.

Sir William Chambers.

Sir William Chambers has observed, that "the Corinthian order is proper for all buildings where elegance, gaiety, and magnificence are required. The ancients employed it in temples dedicated to Venus, Flora, Proserpine, and the nymphs of fountains; because the flowers, foliage, and volutes, with which it is adorned, seemed well adapted to the delicacy and elegance of such deities." This theory, however plausible, is unsupported, or rather contradicted, by facts.

General observations.

The Romans, who appear, as already hinted, to have adopted the Corinthian order in preference to the others, employed it indiscriminately, and erected Corinthian temples to Jupiter, Mars, and Neptune, to whom the Greeks dedicated temples of the Doric order. The temples of Minerva at Athens and at Sunium are Doric; that of Minerva-Polias, at Priene, is Ionic. The temple of Jupiter Olympus at Elis was Doric; that at Athens, built by Adrian, is Corinthian. The numerous temples of the Grecian colonists in Sicily and Italy, are uniformly Doric, marked by the most severe and massive simplicity. The cities of Ionia present the best examples of a chaste and elegant Ionic: and the magnificent structures of Balbec and Palmyra are wholly of the Corinthian order, and in the most florid style of ornament. Whence we may conclude, that the choice of the orders of architecture was rather governed by national taste, than by any ideas of identity between the character of the style, and that of the object to whom the building was to be devoted.

In the following Table will be found the proportions of some of the principal examples of the Corinthian order; in examining which, it is to be recollected, that the several members are measured by the lower diameter of the shafts, which is divided into 60 parts.

Examples.

Examples.	Height of Column.		Height of Capital.	Architrave.	Frieze.	Cornice.
	D.	Parts.	Parts of D.	Parts.	Parts.	Parts.
Portico of the Pantheon, ...	9	$34\frac{1}{4}$	$67\frac{3}{4}$	$42\frac{3}{4}$	$39\frac{1}{2}$	54
Temple of Vesta, at Rome, ...	10	58	$77\frac{1}{3}$	—	—	—
Temple of Vesta, at Tivoli, ...	9	$21\frac{1}{4}$	57	30	$37\frac{1}{2}$	$32\frac{1}{3}$
Temple of Antoninus and Faustina, . .	9	$36\frac{1}{2}$	$68\frac{3}{4}$	$43\frac{1}{2}$	$40\frac{2}{3}$	$52\frac{1}{2}$
Three columns in the Campo Vaccino,	10	$6\frac{5}{6}$	$66\frac{1}{3}$	$43\frac{1}{2}$	$43\frac{1}{3}$	$69\frac{5}{12}$
The Basilica of Antoninus, at Rome, .	10	$11\frac{3}{4}$	$69\frac{1}{2}$	$43\frac{1}{3}$	$32\frac{1}{2}$	—
The arch of Constantine, ...	9	37	$65\frac{3}{4}$	45	40	$58\frac{7}{12}$
Temple at Ephesus, ...	10	15	64	48	$45\frac{1}{3}$	48
Temple at Jackly, near Mylassa, . . .	9	31	63	$43\frac{2}{3}$	40	—
Pœcile at Athens, ...	9	32	$64\frac{2}{3}$	$39\frac{3}{4}$	$34\frac{3}{4}$	$38\frac{3}{4}$
Arch of Adrian, at Athens, ...	9	52	72	41	$38\frac{3}{4}$	46
The Incantada, at Salonica, ...	9	31	$66\frac{3}{4}$	46	$41\frac{1}{2}$	$42\frac{1}{3}$
Palladio, ...	9	30	70	38	$28\frac{1}{2}$	$47\frac{1}{2}$
Scammozzi, ...	10		70	40	32	48
Serlio, ...	9		60	30	37	39
Vignola, ...	10		70	45	45	60

Proportion of capital.
PLATE CLXXXV.
Fig. 1.
No. 1.

Projection of the Corinthian capital. (See Plate CLXXXV. Fig. 1.) No 1. the plan, No 2. the elevation. No 1. the semi-plan, is divided into eight equal parts, which, being carried up perpendicularly to the elevation, gives the centres of the leaves of which the projections are formed by those upon the plan. The length of the diagonal of the abacus is two diameters; the centre of each side is determined by the vertex of an equilateral triangle. The elevation shews the general outlines of the leaves before the foliage is cut.

No. 2.

No 2. shews the general form and manner of raffling the leaves.

No. 3.

No 3. shews the front of the leaf according to the three columns in the Campo Vaccino.

No. 4.

No 4. is a modillion. No 1. being the side, and No 2. the profile.

Modillion.
PLATE CLX.

Practical example: (Plate CLX.) Referring to the manner of explanation of the Doric and Ionic, the ratio of the parts of the Corinthian will be sufficiently evident, from consulting the before mentioned Plate. This example is imitated chiefly from the Pantheon of Agrippa at Rome, it being a chaste and elegant specimen. Others, still richer, may be seen in the works of Sir W. Chambers, and Mr P. Nicholson.

Roman Orders.

Roman orders.
General observations.

Besides the three Greek orders, two others were introduced in ancient Italy, viz. the *Tuscan* and *Composite.* In their general character they are governed by the canons of the Greek school, and have indeed very little claim to be separately classed: Our notice of them will therefore be proportionally confined.

Tuscan.

The title of the first leads us to assign its origin to Tuscany, and this conjecture is strengthened by that people being admitted as the offspring of Dorians. No ancient remains of this order having been discovered with entablatures, it is only from the accounts given by Vitruvius, that the form and ratio of its members can be determined; he allows seven diameters for the height of the columns, and diminishes the upper part one fourth half of the diameter; the base is half a diameter in height, one of which is given to a circular plinth, and the other to a torus; the capital is also half a diameter in height, and one in breadth upon the abacus; the height is divided into three parts, one of which is given to the abacus, one to the echinus, and the third to the hypotrachelian and apophygis; the architrave has two faces, with an aperture between them of about $1\frac{1}{2}$ inch for the admission of air to preserve the beams; the lower face is vertical upon the edge of the top of the column; the frieze is plain and flat; the mutules of the cornice project over the beams and walls, equal to one fourth of the height of the column.

The columns of Trajan and Antonine are specimens of the Tuscan, though being eight diameters high, they exceed, by one diameter, what is generally assigned to this order. St Paul's church, Covent Garden, in London, is the best modern example.

Composite.

In the *Composite order* the upper part of the capital is that sort of Ionic which presents a similar face on each of the four sides. The lower part consists of two rows of acanthus leaves, as in the Attic Corinthian. The column of the Roman edifices, with composite capitals, have, in general, Corinthian entablatures; the arches of Septimius Severus, and the Goldsmiths at Rome, have Ionic entablatures.

Modern architects have generally adopted the entablature of the frontispiece of Nero, or introduced adventitious members of other orders, as the denticulated band of the Ionic with its cymatium, between the modillions and cymatium of the frieze of the Corinthian. The modillions employed in the composite order differ from those of the Corinthian in being more massive, composed of two faces, and having a cymatium like an architrave. Indeed the capital being much bolder than the Corinthian, all the other members should be made of suitable magnitude.

The Romans employed this order chiefly in triumphal arches. The moderns have introduced it in various sort of works of the greatest magnificence.

Of Persians, Cariatides, and Termini.

Cariatides.

Besides columns, the Greeks sometimes supported their entablatures by human figures; when these represented males, they were named Persians, out of contempt for their nation; when the form was of females, they were called Cariatides, as a mark of disgrace to the inhabitants of Caria for having aided the Persians in one of their wars with the Greeks. Whether the Greeks invented this mode, or copied it from the edifices of Upper Egypt, or the temples or tombs of India or Persia, it is not necessary here to inquire. In Stuart's *Athens* there is a fine specimen of Cariatic figures supporting an entablature consisting of an architrave cornice. Various fragments of male figures are also met with amongst Roman antiquities, whose attitudes and acompaniments are evidence of their having been employed for similar purposes. Although, in the bitterness of contest, there may have been a satisfaction in thus employing the figures of their enemies, yet these associations being local and temporary, it is improper to degrade the human form into lasting expressions of slavery, or merely to perform the offices of blocks of wood or stone.

Greeks.
Egyptians.
India.

Termini.

The termini derive their origin from stones employed to mark the boundaries of property. To render these inviolable, Numa Pompilius consecrated them, and built a temple to Terminus on the Tarpeian rock. This deity was at first represented only by a large stone, but in process of time the top of it was cut into the form of a human head and shoulders, and the lower part into the shape of a sheath or inverted frustrum of a square pyramid, which has continued to be the general form, except that sometimes feet are added.

They have been employed as ornaments in gardens, and also at the side of chimney-pieces. They appear subject to similar objections as the Persians and Cariatic figures. To squeeze a man into a sheath, to be constantly exposed to the inclemencies of the weather in gardens, or wasted by a fire while supporting the entablature of a chimney, is, to say the least of it, a blameable conceit.

Colonnade.

Colonnade, a range of attached or insulated columns, supporting an entablature, is named according to the number of columns which support the entablature or fastigium; *tetrastyle*, when there are four; *hexastyle*, when six; *octostyle*, when eight; and *decastyle*, when ten.

The intervals between the columns, measured by their inferior diameter, is called *the intercolumniation*, whence the area between every two columns is termed *an intercolumn*.

Intercolumn.

The intercolumniation is of five denominations, viz. *the aræostyle*, or thinly set, when the columns are at the distance of four diameters; *the diastyle*, when they are at three diameters; *the eustyle*, when at two and a quarter; *the systyle*, when at two; and *the pycnostyle*, or thickly set, when at the distance of one diameter and a half. Of these the eustyle was in most general request among the ancients; and though, in modern buildings, both the eustyle and diastyle are employed, the former has obtained a marked preference. The pycnostyle is frequently rejected from want of room; and the aræostyle is not considered to yield sufficient support to the entablature, and is only applied to rustic structures of Tuscan intercolumniation, where the columns are lintelled with wooden architraves. See Plate CLXXXVI.

Plate CLXXXVI.

The intercolumniations of the Doric order are regulated by the number of triglyphs, one of which is placed over every intermediate column. When there is one triglyph over the interval, it is called *monotriglyph*; when there are two, it is called *ditriglyph*, and so on, according to the progression of the Greek numerals. The intercolumniation of the Grecian Doric is rarely any other than the monotriglyph, there being but two deviations from it at Athens, in the Doric portico, and in the prophylæa; and even in these instances, the exception applies only to the middle intercolumniations, which are ditriglyph, and were necessary from their situation, being opposite to the principal entrances. Indeed, from the massive and bold character of the Grecian Doric, the monotriglyphic succeeded best; but in the Roman Doric it would not be convenient, because the passage between the columns would be too narrow, especially in small buildings; and therefore the ditriglyphic is to be preferred.

When the solid parts of the masonry of a range of arcades are decorated with the orders, the intercolumns necessarily become wide, and the intercolumniation is regulated by the breadth of the arcades and of the piers. Vignola uses the same intercolumniation in all his orders; and though this practice is condemned by some, it is founded upon a right principle, as it preserves a constant ratio between the columns and the intervals.

Coupled columns.

Coupled, grouped, or clustered columns, seem not to have been used by the ancients. In the temple of Bacchus, at Rome, indeed, we find columns standing in some sort in pairs; but it must be observed, that each pair is only placed in the thickness of the wall, and not in the front; wherefore, they may be called two rows of distinct columns, one almost immediately behind the other, rather than a coupled row. In the baths of Diocletian, and in the temple of Peace at Rome, we find groined ceilings sustained by single Corinthian columns, which at once present a meagre appearance, and furnish but an inadequate support.

The moderns seldom employ more than one row of columns in either external or internal colonnades; for in double rows, the back range destroys the perspective regularity of that of the front; and the rays of light, proceeding from both ranges, produce confusion. Pilasters placed behind a row of insulated columns are liable to the same objection, except that the relief is stronger, owing to the rotundity of the one being contrasted with the flat surface of the other.

In buildings upon a small scale, as temples and other ornamental erections in gardens, the intercolumniations, or at least the central one, must be broader than the positive dimensions of the pillars would admit.

Antæ.

Antæ.—Though the earlier architects of Greece were either unacquainted with the use of pilasters, or refused to introduce them in their designs, they frequently placed a kind of square pillars at the ends of their walls, which they called *antæ,* and which sometimes projected to a considerable distance from the principal front, forming the pronaos, or vestibulum. The breadth of these antæ was always much less on the flanks of temples, than on the front; and sometimes they had columns between them, in which case, the return within the pronaos was of equal breadth with the front. The capitals of the antæ never correspond with those of the columns, though they always retain some characteristic marks, by which the order may be distinguished.

Pilasters.

Pilasters are rectangular prismatic projections, advancing from the surface of the wall, furnished with bases and capitals similar to those of the columns whose entablatures they assist in supporting. They differ from columns, in having their horizontal sections of a rectangular figure, whilst the sections of columns are either complete circles, or sections of circles, equal to, or greater than semicircles. They are probably of Roman origin; there being but few Grecian buildings, and those of the latter ages, (except the monument of Thrasyllus,) in which they are repeated at regular intervals, as in the monument of Philopapus; but of their application in Roman works we have numberless instances. Vitruvius calls them *parastatæ.*

When ranged with columns under the same entablature, or behind a row of columns, they have, as we have already observed, their bases and capitals like those of the columns, with the corresponding parts at the same heights: when placed at the angles of buildings, the breadth of the return is equal to that of the front. The trunks, also, have frequently the same diminution as the shafts of columns, as in the arches of Septimius Severus and of Constantine, the frontispiece of Nero, and the temple of Mars Ultor, at Rome. In these cases the top of the trunk is equal to the soffit of the architrave, the upright face of which rests on the capital, in the same perpendicular with the top of the pilaster. When the pilaster is undiminished, and of the same breadth as the bottoms of the columns, the face of the architrave resting on the capital, retreats within the head of the trunk, as in the pantheon of Agrippa.

Pilasters may be either plain or fluted, without regard to the columns. Thus, in the portico of the pantheon, the columns are plain, and the pilasters fluted; but in that of Septimius Severus, the former are fluted and the latter plain, the architects seeming to be governed by no other rule than their taste. The angles, or coins, of fluted pilasters are frequently strengthened with a bead, as in the pantheon, and the flutes are generally of a semicircular section. Sometimes the faces of pilasters are sunk within a margin, and the pannels charged with foliage, arabesque or grotesque ornaments, instruments of music or war, or of all these compounded. In the arch of the Goldsmiths, at Rome, the pannels are decorated with winding foliage and trophies of war.

Pilasters.

When placed on the front or outside of a building, pilasters should project one-fourth of their breadth at the bottom; but in the interior, or behind a row of columns, they should not project more than one-eighth of that breadth.

In a large recess, when an entablature is supported by an even number of insulated columns, with each end terminating and resting on a wall or pier, a pilaster is very commonly placed against each wall or pier, to support the extremities of the architrave. When the entablature over the columns is recessed within the surface of the wall or pier, the pilaster projects towards the column, shewing its thickness on the front, with its breadth facing the void or adjacent column. In this case, the architrave may either profile against the sides of the aperture or recess, or it may return at each interior angle; and again at the exterior angles, proceeding along each wall or pier.

When the intermediate columns and extreme pilasters are so ranged, as to project a small distance beyond the face of the wall at each end, the pilasters shew the same breadth towards the front as towards the void, that the entablature may remain unbroken, as in the chapels of the pantheon; but if breaks be unavoidable, they must be at the extremities, or most distant angles.

Pilasters are not only ornamental to a building, but they also tend to strengthen it greatly; to which we may add, that they become an object of economy, as being less expensive than columns. In situations where they are either placed behind a range of columns, or for the support of the extremes of an entablature across an opening, they are also more concordant with the walls to which they are attached.

Clustered pilasters.

Clustered pilasters, or those which have both exterior and interior angles, with their planes parallel and perpendicular to the front, may be executed with good effect, when the order is plain, as in the Tuscan; but in the Doric, Ionian, Corinthian, and Roman orders, where triglyphs and capitals meet but imperfectly in the interior angles, such a junction should be avoided as much as possible. The same may be observed of Ionic and Corinthian capitals of half pilasters meeting each other in the interior angles of rooms. In the Ionic order, a difference must be made between the capitals of pilasters and of columns; for, in the latter, the projection of the ovolo is greater than that of the volutes; but, the horizontal section of the ovolo being circular, the ovolo is bent behind the hem or border of the volutes; therefore, if a vertical section be conceived to pass through the axis of the column, perpendicular to the face, and another through the middle of the breadth of the pilaster, the corresponding mouldings being equal in both sections; then, because the horizontal section through the ovolo is rectangular, as in the trunk, the ovolo would, if continued, pass over the volutes, or by terminating abruptly, shew the profile of the moulding, which is a palpable defect. It therefore becomes necessary, either to give the ovolo but a small projection, or to make it so prominent in the front, that its extremities may appear to retire behind the border of the volutes; otherwise, the volutes must be twisted from their original plain surface, so that every part of the spirals may be projected towards the eye; or the whole abacus, with the volutes, must be protruded beyond the projection of the ovolo. The same inconvenience will occur in the instances of the Corinthian and composite capitals, in which the upper part of the vase projects beyond the middle of the abacus, and would pass over the faces of the spirals or volutes of the capitals of the pilasters.

Orders upon orders.

Orders upon orders.—In placing one order above another, we shall be naturally led, by the known laws of gravity, to give the strongest and heaviest the lower place, and the weakest and lightest the upper. Symmetry and strength will also direct us to keep all their axis in the same vertical line.

In columns of equal diameters, the altitudes increase from the Tuscan, by the gradations of the Doric and Ionic to the Corinthian. In this progression, we perceive that the Tuscan is stronger than the Doric, the Doric than the Ionic, and the Ionic than the Corinthian; consequently, if the Doric be the lowest order, the succeeding one must be the Ionic; if a third be added, it must be the Corinthian.

Vitruvius, book v. chap. vii. directs the height of the columns of the superior order, to be a fourth less than those of the inferior; but Scammozzi's rule, which is esteemed the best, is, that the lower diameter of the superior column should be equal to the upper diameter of the inferior, so that the different shafts bear the appearance of one long tapering tree cut into so many pieces; a disposition appropriately corresponding to the origin of columns.

According to the rule of Vitruvius, if an Ionic column of nine diameters were to be raised upon a Roman Doric of eight, the lower diameter of the Ionic would be two-thirds of that of the Doric, which is a much less quantity than is to be found in any ancient or modern example of the diminution of the Doric shaft.

In insulated columns, when the diminution of the superior order is very considerable, the intercolumn becomes so wide, and the entablature so small and weak, as to be in danger of breaking, which defect must be still increased, if a third range be added: whence we may again infer, that the theory of Scammozzi is preferable to that of Vitruvius.

Example.

For the sake of example, we shall suppose the stronger order to be made the superior, as the Doric on the Ionic. Here let the shaft of the Doric diminish five-sixths of its lower diameter, and its height will be but six diameters and two-thirds of the Ionic below, which would make a complete attic of the Doric, and render the application of the orders in this inverted manner useless, as they could not be made to accommodate the stories of the building, neither would the upper ranges support their own entablature.

When the front of a building is to have two or more orders in the altitude, the succession must be complete, or the symmetry will be destroyed by the abrupt contrast of the parts. In attached columns, the superior order may be permitted to recede, without danger either of greatly offending the eye, or of impairing the strength of the structure, as may be seen in the theatre of Marcellus. (See Plate CLXXXVI.) But when the stories of orders are insulated, the axis of the superior and inferior columns must be kept in the same vertical lines.

Theatre of Marcellus. Plate CLXXXVI.

In cases where the upper order only consists in the centre of that below, in two equidistant parts from the middle, the portions of the entablature of the lower order, in which there is no superior order, are generally finished with a balustrade, level with the sills of the windows.

We have but few examples in England, of more than two ranges of columns in the same front. Indeed, when there are three, it is difficult to preserve the character of each, without some striking inconsistencies and defects in the intercolumniations.

The first and second orders should stand on plinths, as likewise the third, when there is one; the point of view regulating those of the upper stories. In this case, pedestals should be omitted in the upper orders; but if there be one, or a balustrade under the windows, the base and cornice should have but a small projection, and be continued to profile upon the sides of the columns.

When stories of arcades are raised one upon another, and the piers decorated with orders, the inferior columns should stand on plinths, and those of the upper stories on pedestals, that the arches may receive a due proportion.

In some cases, instead of employing several orders one above another, the ground floor of a building is made in the form of a basement, on which is placed the order by which the principal story is decorated.

Plate CLXXXVI.

In Plate CLXXXVI. examples will be found of orders upon orders, with and without arcades and pedestals. They are taken from the inside of the temple of Paestum,—the outside of the Coliseum,—the theatre of Marcellus at Rome, and Whitehall in London.

Arcades.

Arcades.—When an aperture in a wall is too wide to be lintelled, it is arched over, and receives the appellation of *an arcade*, which term, in the plural number, indicates a continued range of such apertures. They are not so magnificent as colonnades, but are stronger, more solid, and less expensive.

In the construction of arcades, the piers require the utmost care, to have them of sufficient strength to resist the pressure of the arches, particularly those at the extremities. In large arches, the key-stones should never be omitted, and they should be carried to the soffit of the architrave, where they will be useful in supporting the centre of the entablature, which would otherwise have too great a bearing. The altitude of arcades should never be much more nor much less than double their breadth. The breadth of the pier should seldom exceed two-thirds, nor be less than one-third of that of the arcade; and the angular one should have the addition of a third, or even one half more than the rest, according to the nature of the design. The impost should not be less than a ninth, nor more than a seventh of the breadth of the arch; and the archivolt not less than a tenth, nor more than an eighth of the same breadth. The bottom of the key-stone should be equal in breadth to that of the archivolt; and its length not less than one and a half, nor more than double its bottom breadth. In groined porticos, the thickness of the piers depend on the width of the portico and the superincumbent buildings. It should not, however, where beauty and symmetry are consulted, exceed one-third, nor be less than one-fourth of the breadth of the arcade.

When the arcades form blank recesses, with the backs pierced for doors, or windows, or recessed with niches, the recesses should be at least sufficiently deep, to keep the most prominent parts of the dressings entirely within their surface.

The decorations of arcades may consist of rustics, columns, pilasters, cariatides, persians, or termini, surmounted with appropriate entablatures; and when the piers are of sufficient breadth, niches are introduced. The arch is either surrounded with rustic work, or with an archivolt, sometimes interrupted at the summit with a key-stone, in the form of a console, or marsh, or some other appropriate sculpture. In some instances, the archivolt rises from a platband, or impost, placed on the top of the piers; in others, from an entablature, supported by columns on either side of the arch. Sometimes the arches are entirely supported by single or coupled columns, without the entablature, as in the temple of

Temple of Faunus.

Faunus at Rome; but this is departing from the purest Roman style, and approaching to the Gothic.

Arches of Septimius Severus and Constantine.

Amphitheatres.

In cases where the columns are detached, as in the arches of Septimius Severus, and of Constantine, it becomes necessary to break the entablature, and to make its projection over the intercolumns, the same that it would have been had pilasters been used, or just sufficient to relieve it from the surface of the wall. Though this be requisite in all intercolumniations of great width, it should be practised as little as possible, because it destroys simplicity and the genuine use of the entablature. In the upper stories of the theatres and amphitheatres of the Romans, the arcades stood upon the podia, or interpedestals of the columns, perhaps as much for the purpose of proportioning the apertures, as for the formation of a parapet. When columns are destitute of pedestals, they should stand upon a plinth, that the bases may be kept dry and clean, as well as to prevent them from being broken.

The Romans employed arcades in their triumphal arches, and in various other buildings. They may with great propriety be adopted for gates of cities, palaces, gardens, or parks, and are much used in the piazzas or squares of Italian cities. In the latter, they are of great utility for the purposes of shade and shelter in hot or rainy weather, but they darken the apartments of the houses, and, in these northern climates, render them very uncomfortable.

Basement.

Basements. This term is applied to the lower story of a building, whether on a level with, or below the surface of the earth. The height of the basement is determined by its being the cellar or the ground story, or as there may be principal rooms in one or both of them. It should never, however, exceed that of the story next above it, for this would invert the order of the edifice, by making the base of more consequence than the body supported by it.

When the basement consists of the cellar story, it should not exceed five, but at most six feet in height above ground, and may be either plain, rusticated, or formed into a continued pedestal: but when it forms the ground story, it is customary to decorate it with rustics, supported on a base, and surmounted with a crowning string course. The base itself may be either a plinth simply, or a plinth with mouldings over it; the string course, likewise, may be a plain platband, or a platband with mouldings under it; or it may form a cornice.

Rustics.

The rustics are formed of a rectangular or a triangular section, by imagining one of the sides of such section to be a line extended across the front of the joint. The joints of the rustics may be from an eighth to a tenth part of their height. Triangular rustics may have the depth of their joints half their breadth; that is to say, making the two planes by which the joint is formed a right angle. The depth of the joints of rectangular rustics, may be from one-fourth to one-third of their breadth.

Both directions of the joints were marked by the ancients; but the moderns frequently make their rustics with the horizontal joints only; in which cases, they seem rather to represent a boarded surface than a stone wall, whose very nature indicates two directions of joints.

String course.

The string course should never exceed in height that of a rustic with its joints; nor should the socle, or plinth, be less than that of the string course. When the string course is a cornice, the base may be moulded; in such cases, the cornice may be about an eighteenth part of the height of the basement, and its projection about two-thirds of its own height, so as to be less prominent than that with which the building is crowned. The base may be twice the height of the cornice, and being divided into six parts, the lower five may form the plinth, and the remainder be occupied by the mouldings.

Imposts.

When the basement is perforated with arcades, the imposts of the arches may be a platband, equal in height to that of a rustic without its joint.

Pedestal.

Pedestals are used for supporting a colonnade or a pilastrade; and sometimes they supply the office of a basement to a building. They consist of a base, surmounted with a rectangular prismatic solid, called *the die*, crowned with a cornice.

None in ancient Greece, except the temple of Theseus.

The use of pedestals appears to have been an innovation subsequent to the loss of political independence in Greece. In the original examples of Grecian architecture, we find the columns standing on the uppermost of three steps; a rule, to which we know of but one existing exception, to be seen in the temple of Theseus at Athens, which has but two steps. The Romans, however, when they raised the floors of their temples and other edifices high, were under the necessity of discontinuing the front stairs, lest they should prove inconvenient by occupying too much ground around the building, and of adopting the pedestal or podium, raised to a level with the top of the stairs, and projecting to the front of the steps which profiled on its sides.

Vitruvius, in treating of the Doric, Tuscan, and Corinthian orders, makes no mention of a pedestal; and, in treating of the Ionic, speaks of it as a necessary part of the construction, but not as part of the order.

Wherever pedestals are introduced, the grandeur of the order is diminished, as all the parts are proportionally reduced; yet are they indispensible in some situations, as in the interior of modern churches, where, without them, the beauty of the columns would be lost, through so large a portion of them being hidden by the enclosures of the pews.

Proportions variable in Rome.

In ancient Roman buildings, the proportions of pedestals are very variable; but some modern writers have endeavoured to reduce them to a regular standard. Vignola would have them to be one-third of the altitude of the column; but as this appeared to make them too high, Sir William Chambers reduced it to three-tenths; but both ratios must be subject to variation, according to circumstances: Pedestals still lower are to be preferred.

The parts of pedestals may have the following proportions, which may be considered as common to all: Divide the whole height into nine equal parts, and give two to the base, six to the die, and one to the cornice. The base may be subdivided into three parts, of which the plinth may have two, and the mouldings one, which may in general have a projection equal to their height. The plan of the die must be similar to that of the plinth of the column; and the projection of the cornice may be equal to its height.

As to the decorations of pedestals, projecting tablets are inadmissible. It is sometimes customary to adorn the dies with sunk pannels, surrounded with mouldings; and the pannels themselves are occasionally occupied by bas-reliefs or inscriptions. The dies of the pedestals in the arches of Septimius Severus, and of Constantine, have straight-headed niches, containing statues.

Pedestals should never be insulated, though the columns sustained by them be so. In the ancient theatres and amphitheatres, the inferior orders rested on steps, while all the superior orders stood upon pedestals, which formed a parapet for raising the base of the order sufficiently high as to be seen on a near approach to the building, and for the spectators to lean over; but they never exceeded the height necessary for the prevention of accident.

When pedestals were continued with breaks under the columns, or pilasters, in ancient buildings; the breaks were termed *stylobatæ*, and the recess between every two stylobatæ, *the podium*; and both had the same parts disposed at the same levels.

Pediments.

Pediments. These ornaments probably owe their origin to the inclined roofs of the primitive huts. They consist of a horizontal cornice, representing a tie-beam, and two others of equal inclination over it, indicative of rafters, or the latter are exchanged for an arched one. The surface included within these cornices is called *a tympanum*; which, of course, is either a triangle or the segment of a circle. This definition does not include all those species of pediments which have been introduced, perhaps with more fancy than genuine taste, into modern buildings, but only those of the ancients, who, in most things, were close imitators of the prototypes from which they borrowed their designs. In the true pediment, therefore, we only see a representation of the end of a roof whose purpose was to discharge the rain from the the centre of the building, by leading down to the extremities, there to be discharged over the flanks, and not over the front, as must be the case in every figure that can be introduced, except those of a polygonal form, which present their interior angles to the horizontal cornice, or upwards to those of the exterior.

Plates CLVII. CLVIII.

In the antient buildings of Greece, (see Plates CLVII. and CLVIII.), we find only the triangular pediment; but in those of Rome, both triangular and circular are to be met with; and in rows of openings, or niches, both kinds are employed in alternate succession. Though they seem to have preferred the triangular form for doors, windows, and gates, and to have applied the circular pediment to the covering of large or small bodies promiscuously.

Pediments, among the Romans, were exclusively appropriated to sacred edifices, till Cæsar obtained leave of the senate to cover his house with a pointed roof, after the manner of the temples.

The ancients introduced but few pediments into their buildings; even the Romans, usually contenting themselves with a single one to adorn the middle or principal part. But some of the moderns, and the Italians in particular, have become so immoderately fond of them, that sometimes their buildings can hardly be said to consist of any thing besides.

Rule for pediments from Vitruvius.

Vitruvius has given the following direction for finding the pitch of a pediment: "Divide the space between the extremities of the cymatium of the corona into nine equal parts, and take one for the height of the tympanum." This rule, however, is incorrect; because the tympanum will vary its angle according as there are more or less mouldings of the inclined cornices within the extremities of the cymatium of the corona; and since, by this rule, the middle part is invariable, and the broader the parts are of the inclined cornices within each extremity of the cymatium of the corona, (or rather within the under edge of the fillet of the sima upon each inclined cornice), the less will be the base of the tympanum; consequently, the three angles will be less acute. But were this height extended to the meeting of the two under sides of the fillets of the sima, or crowning moulding, the figure of the tympanum would be invariably the same.

The foregoing rule of Vitruvius has been considered as too low; but it must be recollected, that that of the octostyle portico of the Parthenon at Athens, is nearly of the proportion there described; that of the hexastyle portico of the temple of Theseus, is about an eighth; that of the Ionic temple on the Ilyssus, and of the Doric portico, which are both tetrastyle, are about one seventh; and the tympanum of the pediment over the door of the tower of the Winds, is about one-fifth of the span; all which edifices are Athenian.

From this comparison, a kind of reciprocal ratio seems to exist between the extension of the base of the tympanum and its height; and, indeed, were a fixed ratio applied to windows, the pediment would frequently consist of a cornice only, without any tympanum. It is, therefore, with good reason, that the pitch of pediment windows is frequently made greater than of such as crown porticos or the fronts of buildings.

Pediments are sometimes decorated with plinths, called *acroterions*, or *acroters*; of which, Vitruvius observes, the two presenting triangular faces at the extremities, each in height half that of the tympanum, and the middle one, saddled on the summit, is one-eighth higher than the others.

It is an observation of Vitruvius, that "the Greeks never used mutules, modillions, or dentils, in the front, wherein the end of the roof or fastigium appears; because the ends of the rafters, and of the laths which support the tiles, only appear at the eaves of the building; and as mutules and dentils originated from the projecting ends of the rafters and laths, it would have been absurd to introduce them into the pediment, where the exemplars are themselves to be seen." But, just as this argument is, we find in the Grecian remains, that though neither mutules, dentils, nor modillions, are employed in the sloping sides, mutules are constantly used in the horizontal cornice. In edifices of the period of Roman domination in Greece, indeed, we sometimes may observe them in the sloping cornices, but they must be considered as innovations. At Rome, we have examples of modillions in the Pantheon, and in the frontispiece of Nero; and in the temple of Fortune, dentils are used. In the inclined cornices, the sides of the modillions and dentils are planes perpendicular to the horizon and to the front of the edifice, and in the same vertical planes of those of the horizontal cornice.

Attics.

Attics. Among the Athenians, it was a rule to conceal the roofs of their buildings, for which purpose they crowned their cornices with low square pillars, of a form nearly approaching that of a pedestal, which have obtained the appellation of attics, from the country in which they were first, or chiefly employed, though no remains are now to be discovered among the ruins of the ancient city of Athens.

Roman attics are to be seen in the remains of the triumphal arches, and in the piazza of Nerva. In the arch of Constantine, the columns are surmounted with pedestals, as high as the base of the attic, upon which are placed insulated statues. At Thessalonica, there is an attic over a Corinthian colonnade, with breaks forming dwarf pilasters over the columns, as in the arch of Constantine. The attic which is carried round the two courts of the great temple of Balbec, is also broken into dwarf pilasters over the columns and pilasters of the order; which dwarf pilasters are surmounted with blocking courses, wherein statues are supposed to have stood.

In all these remains, the attics are disproportional; some of them being nearly one half of the height of the order. The moderns make their height equal to that of the entablature; and the proportion of that of the members may be regulated as in the case of pedestals.

Niches.

Niches. These decorations consist of recesses in a wall, either for the purpose of embellishment, or for receiving statues or other ornaments. They may be formed with spherical heads, and cylindrical backs, or entirely with hemispherical backs, or with spheroidal backs, having the transverse or conjugate axis of the ellipses vertical, as may best comport with the character of the object to be placed therein. Those with spheroidal backs may have their horizontal sections in circles of different diameters, and consequently, their sections through the vertical axis, all equal semi-ellipses, similar to each other; or all their horizontal sections may be similar ellipses, and the sections through the vertical axis of the niche will be dissimilar ellipses of equal heights, at least for one half of the niche; but spheroidal niches with such sections are difficult of execution, and more pleasing to the eye than those with circular horizontal sections. Among the works of the Romans, niches have either a circular or rectangular plan; the heads of those of the circular kind are generally spherical. In the middle of the attic of Nerva, at Rome, a niche is seen with a rectangular elevation, and a cylindrical back and head. Those upon elliptic plans were not much used by the ancients; though in Wood's "Ruins of Palmyra," there are two niches with elliptical heads, within the entrance portico of the Temple of the Sun; but the author has given no plan of them. Most frequently, those upon rectangular plans, have horizontal heads, though a few are to be met with that have cylindrical heads: those upon circular and rectangular plans, are, for the sake of variety, most commonly placed alternately.

The plans of niches with cylindrical backs, should be semicircular, when the thickness of the walls will admit of it; and the depth of those upon rectangular plans should be the half of their breadth, or as deep as may be necessary for the statues they are to contain: their heights depend upon the character of the statues, or on the general form of groups introduced, yet seldom exceeding twice and a half their width, nor being less than twice. Those for busts only, should have nearly the same proportion in respect to each other. In some cases their height may rather exceed the measure of their breadth: they may be of any of the forms used by the ancients, or of those mentioned at the beginning of this article.

In point of decorations, niches admit of all such as are applicable to windows; and whether their heads be horizontal, cylindrical, or spherical, the enclosure may be rectangular. In antique remains, we frequently meet with tabernacles as ornaments, disposed with alternate and arched pediments; the character of the architecture should be similar to that placed in the same range with them.

Niches are sometimes disposed between columns and pilasters, and sometimes ranged alternately, in the same level with windows: in either case they may be ornamented in plain, as the space will admit, but in the latter, they should be of the same dimensions with the aperture of the windows. When the intervals between the columns or pilasters happen to be very narrow, niches had better be omitted, than have a disproportionate figure, or be of a diminutive size.

When intended for containing statues, vases, or other works of sculpture, they should be contrived to exhibit them to the best advantage, and consequently the plainer the niche, the better will it answer the design, as every species of ornament, whether of mouldings or sculpture, has a tendency to confuse the outline.

Remarks.

Having described the several parts of which the buildings of the Greeks and Romans were chiefly composed, we shall proceed to give some account of the principal edifices in which they were introduced, leaving the investigation of the other parts of practice, which relate more immediately to modern works, till we come to speak of the revival of Roman architecture in Europe. The edifices now to be treated of are ancient temples and villas: Their places of public exercises and amusements are referred to other articles in this work.

Of Greek Temples.

Greek temples.

The Greek temples were all of an oblong form, with an entrance in the middle of one or both of the shortest sides. The roofs were generally continued (except in the hypæthral) in the direction of the longest sides, terminating at gable ends or pediments, raised in the shape of the roof upon the shortest sides or ends. One of the orders of architecture was usually employed upon a part or the whole of the edifice. They were distinguished into different sorts, either from some parts of the general form, or the number or distribution of the columns, or the distance at which these were placed from each other.

Denominations.

1. When a part of the inside space next the walls was covered with a roof, and the middle left uncovered, the temple was named *Hypæthral.*

2. When there were columns only at the end where the entrance was, the temple was named *Prostyle.*

3. When there were columns at both ends, the temple was named *Amphiprostyle.*

4. When there were columns at both ends, and also along each side, the latter being placed at a distance from the outside of the walls equal to that between those at the ends, and the columns at each angle standing in a line with, and being common to each row in the adjoining sides, the temple was named *Peripteral.*

5. When along each side there were two rows of columns at a distance from each other, and the inner row from the walls equal to the distance between the columns at the ends, all the other circumstances remaining the same as in the preceding definition, the temple was named *Dipteral.*

6. When all the circumstances in the two immediately preceding definitions remain the same, only the inner row of columns on each side being removed, the temple is denominated *Pseudodipteral.*

7. When there are columns at each end, and the sides have attached columns, projecting only half or a greater part of their diameter, the temple is named *Pseudodipteral.*

8. When the side walls are continued, so as to be in a line with the column at one or both ends, so as to occupy the place of the angular columns, by supporting the entablature, the end of each projecting wall being terminated by vertical rectangular prisms, having mouldings in place of a capital at the top, the temple is said to be *in Antis.*

Temples also receive appellations from the number of columns placed at one or both ends, and in all those of Grecian origin, with the exception of that at Pæstum, (which has nine) the number is always even. When there are 4, 6, 8, or 10, the temple is said to be *Tetrastyle, Hexastyle, Octostyle,* or *Decastyle.*

The temple *in antis,* had usually only two intermediate columns.

The prostyle temples were generally tetrastyle, or with four columns.

The hexastyle and octostyle were generally peripteral, though there is an exception in the octostyle temple of Bacchus at Teos, being pseudodipteral.

The decastyle peripteral temples were generally hypæthral, but the Parthenon at Athens is octostyle hypæthral. This arises from its great breadth.

Temples had also names depending on the distance at which the columns were placed from each other. The interval is called intercolumniation, and is measured by the lower diameter of the shaft. When it is 1½ diameter, it is named Pycnostyle; when 2, Systyle; when 2¼, Eustyle; when 3¼, Diastyle; and when 4, Aræostyle. Of all these, the eustyle has been most generally practised both by the ancients and moderns.

Pronaos and posticum.

The space between the columns and wall at the entrance or front end, is denominated pronaos. The similar space at the opposite end, the posticum. The space within the walls was called the cell.

In the hypæthral temples, besides rows of columns along the outside, there were also rows within the cells, and these were placed sometimes along each of the four sides, and sometimes along the longer sides only. These were necessary to support the roof, and were named Peristyle. In some instances, as in the temple of of Minerva at Tegea, and at Pæstum, the inner rows consisted of two heights of columns; but it is proper to observe, that, in both these specimens, the upper rows have, by judicious persons, been ascribed to the Romans.

Peristyle.

In the application of the Doric order to temples, the intercolumniation was regulated by the triglyphs. Where there was only one between the columns, the mode was denominated monotriglyph, and it was almost the only one employed in the Grecian edifices.

General remarks.

In the Greek temples, the number of columns along each flank or longer side, was always one more than double the number along the front, or shorter side; that is to say, if there were eight columns along the front, there were seventeen along the flanks, counting the angular columns both in the front and flank ranges. These temples were raised upon an artificial platform, ascended by three steps, which surrounded the whole building. The outer row of columns, which stood upon the upper step with their accompanying entablature, also surrounded the building without a single break. The pediments upon the ends, the whole of the frieze along the columns, and likewise that along the walls under the portico, were frequently filled with the most exquisite sculptures.

We shall now proceed to produce some examples from Greek temples which still exist; and as works executed under the influence of Pericles, and the immediate direction of Phidias, must exhibit the essence of Greek taste, we have selected those formed in the Acropolis at Athens, as faithfully measured and delineated by Messrs Stuart and Revet, and which fortunately afford perfect specimens of the Doric, Ionic, and Cariatides.

Minerva Panthenon. PLATE CLVII. Dimensions.

The magnificent temple, dedicated to Minerva Parthenon, (see Plate CLVII.) which stood within the Acropolis, was 225 feet in length, and 100 feet in breadth, measured on the top of the third step which surrounded the building. There were eight Doric columns in each front, and seventeen on each side, counting those at the angle twice. They were without bases; the row which surrounded the whole buildings were those at the angles 6 feet 3.5 inches, all the others 6 feet 1.8 inches diameter; and, including the capitals, were 34 feet 2.8 inches high. The intercolumns, next the angles, were each 5 feet 8.8 inches, all the others 7 feet 11.5 inches. The height of the architrave was 4 feet 5.1 inches, and of the frieze, including the cap of the triglyph, the same. The height of the cornice, exclusive of the top member, 2 feet 4.6 inches. The depth of the spandrel of the pediment, at the middle, 11 feet 6 inches. The inner row of columns in the portico at each end, stood two steps higher than the outer row. These steps also passed quite around the cell. The diameter of these columns was 5 feet 6.5 inches. The distance from centre to centre of those next the antæ was 12 feet 0.3 inch; of the others 13 feet 9 inches. The breadth of the front of the antæ 4 feet 11.7 inches. A peculiarity here was, that the inner row of columns stood before the antæ; whereas, in other temples, they usually had the antæ in a line with them. The column shafts were fluted. The flutes were shallow, and met in a sharp edge. They reached from the bottom of the shaft to the underside of the cap; and here were cinctures in place of astragals. In the soffit of the entablature were mutules, with 18 drops in each. The soffit, at the external angles, was decorated with honeysuckles. All the metopes in the frieze (92 in number) have been enriched with sculpture. Those on the south side have each a groupe, representing a Centaur combating a Lapitha; they are in the finest alto relievo. Those on the northern sides and two fronts were more defaced. On the frieze, under the porticos, which encompassed the cell, and measured 520 feet in length, and 3 feet 4 inches in height, was represented the Panathenaic procession. Sixty feet on each side have been occupied by horsemen, who attend the festival. They were preceded by charioteers. In the last is a youth, supposed a victor in the chariot races. A man is about to crown him. There are also sacrifices. On the eastern pediment was an assemblage of the gods, in which Jupiter appears to be receiving Minerva, and acknowledging her as his daughter. On the pediment at the other end was represented Minerva's contest with Neptune. From the front of the inner columns to the front of the wall of the cell, the distance is 17 feet 6.2 inches. The thickness of this wall is 6 feet 7.9 inches. The entrance doorway is 12 feet 6.75 inches wide, and 28 feet 8 inches high. Here is an ascent of about one inch into the Pronæus, which had been covered and supported by six columns, viz. three on each side. It was the Opisthodomas, or place where the public treasury was kept. The length 43 feet 9.75 inches; the breadth 62 feet 6 inches. From this apartment was a doorway of equal breadth to the former, which opened into the great apartment, 98 feet 7.25 inches in length, and 62 feet 6 inches in breadth. The wall, which divided this from the Pronæus, was 2 feet 11 inches thick. The side or outer walls each 3 feet 10.3 inches. A space 15 feet in breadth along the sides, and 14 at each end, was covered and supported by a row of columns. The middle space between these columns was open, and sunk about one inch below the level of the sides. It was in this division that the famous statue of Minerva stood. Wheeler and Spon, who visited Athens in 1676, being 11 years before the Venetians destroyed the roof, saw within the cell, on each side, two rows of columns, one above another, standing at some distance from the wall. The decorations of the eastern front prove it to have been originally the principal entrance. Under Phidias, the architects were Callicrates and Ictinus. It was built of Pentilic marble; and the inimitable sculptures which adorned its pediments and friezes, partly acquired to this country by the exertions of Lord Elgin, shew the degree of perfection to which the Greeks had carried that art, (see ATHENS.) Reflections have been cast on that nobleman, for thus de-

Sculpture.

Architects.

Exertions of Lord Elgin.

priving this splendid ruin of its appropriate decorations. If it had been possible to have preserved it inviolate, he would have undoubtedly been blameable; but when it is considered that the hand of ignorant barbarism had already, during a recent period, converted one inimitable structure into lime for mortar, and materials for constructing filthy huts; and had also laid sacrilegious hands upon the Parthenon itself; and that depredations had likewise been commenced by a power, which, from its extensive spoliations in other quarters, left no room to doubt its intentions here, this active nobleman, instead of being exposed to censure, ought to receive the warmest acknowledgments of the British artists and nation.

In the preface to the third volume of Stuart's Antiquities, by Revely, we learn that the columns of the Temple of Minerva were composed of single blocks in thickness; that each course was somewhat more than one diameter high; that the wall inclosing the cell was formed of a single row of marble blocks in thickness; that the vertical joints alternately corresponded; that from the top of the upper step to the bottom of the architrave, being 33 feet, there were 17 courses; that each capital was of one block, 2 feet 9.9 inches high; that the architrave lies upon them without any other precaution than perfect accuracy. The architrave consists of three blocks in thickness, each reaching from centre to centre of the columns. The frieze is in two courses in height, and each of them so much short of thickness, as to admit the metope, a thin slab, to be placed against it. The triglyph tails in, in one height, but does not go through. The cornice is in blocks, which are the width of one mutule and one space, their ends forming a complete course in the inside. The tympanum of the pediment is formed of one course of upright slabs on the outside face, with horizontal courses behind them. The pavement is formed in squares of equal size; they are large and thick; the joints, as in the universal practice at Athens, are so neatly fitted, as scarcely to be discernible.

Minerva Polias, Erechtheus, and Pandrosus.
Plate CLVII.
Ionic order.
Cariatides.

Adjacent to the Parthenon stood the singular and beautiful structure, which contained the temples of Erechtheus or Neptune, of Minerva Polias, (or protectress of the city,) and that of Pandrosus, one of the daughters of Cecrops, (see Plate CLVII.) The principal mass of the building was of an oblong shape, with a portico of six Ionic columns at one end to the temple of Neptune, and four of the same order to that of Minerva. There was also another portico of six Ionic columns, which projected partly from the side, and partly extended beyond one angle of the temple of Minerva. Opposite to this, on the other side of the last mentioned temple, was a small projection which composed the temple of Pandrosus; and the front of this projection was supported by Cariatides. The floor of the temple of Neptune was about eight feet above the level of the other two. This irregularity of height and shape produces a fine effect, as will be observed by consulting Plate CLVII. The columns of the portico of the temple of Neptune, including the base and cap, are 21 feet 7.8 inches high, and 2 feet 3.8 inches diameter. The intercolumns, from centre to centre, are 6 feet 11.2 inches. Distance from the centre of column to the face of the wall 6 feet 5 inches. The columns of the temple of Minerva are 22 feet 10 inches high, and 2 feet 9.34 inches diameter. The intercolumn, from centre to centre, is 10 feet 3.6 inches. The shafts of the columns are fluted, and the neck of the caps enriched with honeysuckles. The caps are also enriched, as is one member of the architrave and two of the cornice. The same enrichment, as on the neck of the capitals, is carried along the sides of the cell under the general architrave, being a continuation of the cap of the antæ. The base, capitals, and entablature of the portico to the temple of Minerva are beautiful. The upper torus of the base of the column is enriched with a Guilochi. The base nearly resembles the attic, only the lower torus and plinth have more projection, which adds to the apparent stability. The capitals, at the external angles, have each a horn, like the modern Ionic. The height of the architrave is 2 feet 1.25 inches. The frieze 2 feet 2.6 inches. Level cornice of pediment only 11.3 inches. The windows to the Pronaus, which light the temple of Minerva, are 6 feet 4.36 inches in height; they are 3 feet 1.1 inch wide at the bottom, and 2 feet 10.35 inches at the top. The architrave stands on a sill at the bottom, and has a break on each side at the top. The height of the Cariatides, in the temple of Pandrosus, is 7 feet 9.15 inches, including the caps. The figure only 7 feet 1.05 inches. The entablature they support is 2 feet 11.8 inches. It is very heavy, but highly enriched. This is the only ancient temple in which the entablature is supported by Cariatides. In the temple of Minerva Polias was placed the celebrated golden lamp, made by Callimachus, the inventor of the Corinthian capital. This temple was burnt by Xerxes. The inscription, published by Dr Chandler, contains a survey of the parts which remained to be completed in the 23d year of the Peloponnesian war. The estimate of the expence was from £300,000 to £400,000 sterling. Hence, it is not improbable, that this structure was begun during the administration of Pericles, and a stop put to it by his death, or by war.

Plate CLVII. Dimensions of order.
When completed.

Temple of Theseus.

The temple of Theseus at Athens, was one of the finest remains of the age of Pericles. It was entirely built of Pentilic marble. It was a peripteros of the Doric order. The total length upon the upper step was 104 feet 2.9 inches; the breadth 42 feet 2.95 inches. The portico consisted of six fluted columns, and 13 on each side, counting those of the angles twice; the height including the capital, 18 feet 7.18 inches; the diameter, 3 feet 3.4 inches; the intercolumn 5 feet 3.95 inches, and 5 feet 4.05 inches, and next the angle 4 feet 6.35 inches. The height of the architrave was 2 feet 8.9 inches; the frieze, 2 feet 8.53 inches; the level cornice, 1 foot 0.45 inches. The metopes and frieze under the portico were enriched; there is also a very rich Guilochi over the latter. The principal front faced the east; here the pediment was filled with exquisite sculpture in alto-relievo, fixed in their places by metal cramps. In the metopes, in this front, were represented the labours of Hercules; and in the four metopes next this front, in the north and south sides, were the labours of Hercules. The length of the cell, exclusive of the portico, pronaus, and posticum, was only 39 feet 9.2 inches, and the breadth 20 feet 4 inches.

Temple of Corinth.

The only temple at Corinth of which there are any remains, is of the Doric order, evidently before the age of Pericles. It is built of a rough stone. The height of the column, including the capital, is 23 feet 8¼ inches; the diameter 5 feet 7 inches. The shafts have each been of one stone; they begin to diminish from the bottom. They have 20 flutes, which terminate under the listil of the cup; they are segments of circles. The height of the architrave, including the bands over the drops, is 4 feet 9¼ inches. The guttæ are round and detached from the architrave; there are six drops under the triglyphs.

Temple of Ceres at Eleusis.

From Dr Chandler we learn, that the temple of Ceres at Eleusis, was erected under the direction of Pericles, from a plan of Ictinus, one of the architects of the Parthenon. It was situated at the east end, and under the brow of a hill, and was encompassed by the fortress. The length, including the pronaus or portico, was 216 feet; the breadth of the cell about 150. The temple was originally *in antis*, or without exterior columns. Under Demetrius the Phalerian, the celebrated architect Philo added a magnificent portico, the outer row of which consisted of ten, and the inner row, between the antæ, of eight Doric columns. They were 6 feet 6 inches in diameter, and fluted, commencing six inches from the bottom of the shaft. From the inside of the column to the face of the wall, the pronaus was 42 feet 6 inches deep, and about 140 feet in width. The columns on the pavement within, and their capitals, were by Corætius. Metagenes of Xypate added the architraves on the upper pillars, which sustained the roof. It is said that another person completed the edifice. The peribolous, or enclosure which encompassed the north-east and south sides, was 387 feet from north to south, and 328 from east to west. On the west side it joined the angles of the temple. Between the west wall of the enclosure and the temple, and the wall of the citadel, was a passage 42 feet 6 inches wide, which led to the summit of a high rock. At the north-west angle of the enclosure are the traces of a temple *in antis* 74 feet 6 inches long, and 54 wide, probably sacred to Triptolemus. North of the enclosure are marble fragments of the Doric and Ionic orders, thought to be the remains of the temples of Diana Propylea, of Neptune, and of the Propyleum, or gateway.

Jupiter Olympus at Elis.

The temple of Jupiter Olympus, at Olympia in Elis, from a design of the architect Libon, was of the Doric order, 231 feet long, 96 broad, and 68 high. On one pediment, Oenomans and Peleus were disputing the prize of the race in the presence of Jupiter; on the other was the battle of the Centaurs and Lapithæ. On the summit of each pediment was a Victory of gilt brass; and at each angle a large vase of the same metal. The labours of Hercules decorated the gates, in the Doric temple of Jupiter Olympus at Girgenti, the ancient Agrigentum, which were more than 12 feet diameter. Those of Silenus, now remaining, are ten feet.

Diana at Ephesus.

The celebrated temple of Diana at Ephesus, constructed at the joint expense of all Asia, was of the Ionic order, and designed by Ctesiphon the Cnosian, and his son Metagenes, who wrote a treatise upon it. It was situated at the foot of a mountain and the head of a marsh, a place chosen, in Pliny's opinion, as least subject to earthquakes. In order to protect the site of the structure, drains were constructed to collect and convey the water along the skirts of the mountain. By the same author we learn, that, in order to render the foundations secure, they first laid a thick bed of charcoal well rammed, and upon that one of wool; and that the quantity of stones employed in the foundations of the edifice and drains was such as to require quarries so extensive as to be in after ages taken for a labyrinth. The temple was 425 feet in length, 220 in breadth, and 70 in height. It had a double row of Ionic columns along the flanks of the cell. In page 361 of Wren's *Parantalia*, are the following observations respecting this structure. "The columns being sixty feet high, the diameter, according to rule, must be 6 feet 8 inches, that is, one-ninth part. Thus every column would contain 110 tons of marble, besides base and capital; and the vast stones of the entablature, but more especially of the middle intercolumn, which being wider than the rest, to open more way for the entrance, as usual in Greek temples, was about 22 feet, and could not bear its own weight, unless the architrave and frieze were of one stone, which together would be above 150 tons; the setting of which (for it seems the architect despaired) was miraculously attributed to the goddess herself, as beyond the reach of human skill. Thirty-six of the columns were by the hands of Scopas, a famous statuary of the school of Praxiteles; and the outward walls of the cella were adorned with pictures about the time of Apelles." According to Pliny, 400 years were employed in constructing this temple.

Diana at Magnesia.

In the Ionic temple of Diana at Magnesia, designed by that Hermogenes whose merits are highly extolled by Vitruvius, the general dimensions are the same as the Dipteros; but having, in order to obtain more free space under the flank porticos, omitted the inner range of columns, he thereby established the pseudo-dipteros; but unless he continued the wooden beams of the roof over this increased space, this mode was impracticable, unless when the quarries afforded marble blocks of very large dimensions.

Minerva at Tegea.

In the magnificent temple of Minerva at Tegea, designed by Scopas, the peristyle which surrounded the temple consisted of columns of the Ionic order; but in the cell, which was divided into three aisles by two rows of columns, each row consisted of two heights, the lower range being of the Doric, and the upper of the Corinthian order; and this is the only instance in which two different orders are placed one above the other in a Greek temple. And where the Corinthian order is at all introduced, these circumstances have induced an able critic (Knight *On Taste*, p. 178.) to suppose, that these upper columns have been, during a repair of the edifice, raised after the Roman conquest. In this temple, the sculpture in both pediments was by Scopas; the subject of the one was the hunting the wild boar of Caledon, in which the figures of Hercules, Theseus, Pirothous, and Castor, were conspicuous; on the other pediment was exhibited the combat of Achilles and Telephus.

Jupiter Olympus at Athens.

There is no vestige of any temple in Greece of the Corinthian order previous to the Roman conquest; for the temple of Jupiter Olympus at Athens, though begun by Pisistratus, was built under the reign of Hadrian, by Cossutius, a Roman citizen (*Vitruv.*). Its length, measured on the upper step, was 354 feet 2 inches; the breadth 171 feet 2 inches. There were ten columns in the outer rows, at each end; and 21 along each side, (counting those at the angles twice). Their diameters were 6 feet 6.85 inches, and 6 feet 4.332 inches, and the height 60 feet. The shafts were fluted, but not to an edge. The bases were attic. There was one row of columns along each side, in the inside of the cell. The length of the court which encompassed the temple was 688 feet 6.5 inches; the breadth 463 feet 5.87 inches. But this magnificent work cannot be termed Grecian.

General remarks.

Having explained the several denominations under which the Greek temples were known, and given some account of ten of them, we conceive it quite unnecessary to pursue this part of the subject further, especially as the elementary parts have already been discussed and illustrated in treating of the different orders, &c.; we shall therefore now proceed to give a description of a Greek house and villa.

Private houses.

The Greek houses generally consisted of two sets of apartments; the upper story for the women, the lower for the men. The roofs had terraces, with a large projection at each extremity. A considerable number had gardens behind them, and a small court in the front, or rather a sort of portico, at the end of which there was a door. At this place there was always either the figure of Mercury or a dog, to frighten thieves; also an altar to Apollo, upon which the master sacrificed on certain days. In process of time, wings were added to the houses, and the apartments of the husband and wife were both placed on the same floor.

The house of Ulysses, which must have been the palace of Ithaca, had a court before it, surrounded by a stone-wall with a coping. In this the gateway had folding doors; but there appears to have been only one apartment for receiving and entertaining strangers; and in this the slaughtering and cooking were likewise performed. It was entered immediately from the court. One stair led from it to the roof, and another to the storerooms, or perhaps the bedrooms. The floor was below the level of the threshold, and was paved with stone. The windows must have been very high, as the suitors, when attacked, could not reach them. The area of this apartment must have been very extensive, but we have no data for ascertaining the precise dimensions.

Plate CLXI.

In Plate CLXI. taken from Palladio's explanation of the description given by Vitruvius, it will be seen, that the Greeks, in their most magnificent villas, had no vestibule adjacent to the street, but a narrow passage, or gateway, on one side of which were stables, and on the other porters' lodges. From this passage there was an entrance to the peristylium, which had porticos on three sides. On the side facing the entrance, or that which looked towards the south, there was no portico, but a wide aperture, with antæ on each hand, which led into an oblong porch. On the right and left of these were three apartments on each side, called antichamber, chamber, and backroom. Behind these were apartments for the women and their attendants; and round the portico were rooms for dining, sleeping, and servants' rooms. Behind this edifice was another still more magnificent suit of apartments, appropriated wholly to the men. Here the peristylium was of greater extent, and the rooms more spacious and highly decorated. The porticos of this peristylium were four: They were sometimes all of an equal height; and sometimes three of them only, the fourth, or that on the north side, being higher than the rest. The dining-room fronted the north, as did the rooms for pictures. Those for conversation, or sleeping, looked to the west, and the libraries toward the east.

Apart from all these edifices, on either side, the lodgings for strangers were separated by passages, and were entered by distinct gates. They consisted of complete suits of apartments, with store-rooms furnished with provisions; and here, after the first day's visit, they resided in a separate dwelling.

Of Roman Temples.

Roman Temples.

The Romans did not, like the Greeks, adhere to simplicity in the form of their temples; they, on the contrary, deviated into every shape, even to complicated combinations of circles and triangles; but as it would be as endless as useless to notice such frivolities, we shall only select a few of the best specimens, which were either of an oblong or circular form.

Temple of Peace.

Of those, in which the outlines inclosed an oblong space, the great temple of Peace at Rome is the most noted example; and this was likewise the largest of the Roman temples. In our descriptions and dimensions of this, and also the other ancient remains at Rome, we shall be chiefly guided by Desgodetz, who seems to have been at great pains in measuring and delineating them with accuracy.

This temple was begun by Claudius, and completed by Vespasian; who, when he had subdued Judea, placed there the spoils of the Jewish temple. (See Plate CLXIV.) It was in length fifty-six fathoms, (336 French feet), and forty-three fathoms (258 French feet) in breadth; at the entrance, there was a lobby or porch of the same breadth as the temple. This porch had five entrances, of which three led immediately into the great middle division or nave; the other two opened into the side divisions or aisles, which were not carried up so high as the nave. The breadth of the nave was 77 feet 5 inches, and each side aisle 48 feet. The ceiling or roof of the nave was an immense groined vault, which rested upon eight Corinthian columns. The aisles had also vaults lengthwise, which were intersected by others, that covered the recesses or chapels which projected outward from their side walls. The middle recess of the aisles, as well as that at the end of the nave, were circular like large niches, and nine fathoms wide. The recesses, which have not large niches, have two rows of arched windows in them, three in each row; there is also over each recess a large window, five fathoms broad. The soffits of all the vaults, and also the coverings of the niches, are ornamented with octagonal sunk pannels, formed with stucco. Excepting the entrance, which had a portico composed of columns and a pediment, all the outside was quite plain. We are informed by Desgodetz, that the only remaining column, (we suppose he means of the portico), was removed by Pope Paul V.; it stands before the church of St Mary Major, supporting an image of the Virgin in bronze. It is of white marble, of the Corinthian order, 5 feet 8¼ inches (French) diameter at the bottom; the shaft (of one piece) is 49 feet 3 inches high. The architrave and cornice are enriched; the frieze is plain.

Plate CLXIV.

Groined arches.

Montfaucon says, that this temple was 340 feet long by 250 broad, that the portico was 240 feet long by 30 broad; that there were eight columns in front, each 8 feet 9 inches diameter. Serlio gives a plan with eight small columns, viz. two on each side of four niches; and Laurus gives an elevation with only six columns; so that there seems to be very little certainty as to the portico. Beside the Jewish temple, Egypt contributed to enrich this repository of spoils; for within it was placed the celebrated groupe of black marble, representing the Nile and sixteen children, expressive of the sixteen cubits rise of that river. In the time of Commodus the inside was burnt by an incendiary.

Square house at Nismes.

Though of much smaller dimensions, the square house at Nismes, and the temple of Fortuna Virilis at Rome, are more in the Greek manner, their general form being oblong without any breaks. The former was built by Hadrian; it is 74 feet long, and 41 in breadth; the portico consists of six fluted Corinthian columns in front, and three in depth; on the flanks, counting those at the angles, there are eleven columns, but those opposite the sides and arriere end of the cell, are only semi-columns attached to the walls. The temple of Fortuna Virilis at Rome, (See Plate CLXIV.) is still smaller, being only 54 feet 8¼ inches in length from center to center of the angular columns, and 28 feet 8½ inches in width. It has only four columns in breadth of portico, and two in depth; and in the pronaos the two inner ones are omitted; and instead of the side walls being continued and finished with antæ as in Greece, there are columns attached to each of the external walls of the cells, which shew a semi-column both in front and flank; along the flanks and arriere end of the cell are semi attached columns. The columns are beautiful Roman Ionic, fluted and raised upon a pedestal, which, including two steps on the top of it, also surround the edifice, is 10 feet 5¼

Temple of Fortuna Virilis at Rome. Plate CLXIV.

inches high. The columns, including the base and capital, is 25 feet 4¼ inches high, and 2 feet 11 inches diameter. The entablature is 6 feet 8½ inches high, but has the parts ill proportioned; the architrave, 1 foot 4¾ inches, consists of a number of small plain mouldings; the frieze is only 1 foot 10¾ inches, and enriched; the cornice is 3 feet 5 inches, with a dentil band, and two other enriched members. The whole entablature has the appearance of a clumsy cornice, but being continued round the edifice without a break, preserves a great degree of simplicity. The plinth and dado of the pedestal are plain, but the face of the walls between the columns is rusticated.

Palmyra.

Of the other rectangular temples of the Romans, those of Palmyra and Balbec are not only the most extraordinary in point of extent, but are also in the highest style of decoration to which Roman architecture was carried. For a description of the general plan of the place, and of the various remains found within the precincts of Palmyra, we must refer to the valuable volume published by Messrs Dawkins and Wood in 1753, and for a specimen of the architecture, confine ourselves chiefly to an account of the temple of the Sun. The court in which the temple stood, measures over the walls, (by the scale upon the Plate,) 740 feet from north to south, and 720 from east to west. These inclosure walls consisted of a basement, or regular pedestal, about 16 feet in height; a plinth 2 feet 10 inches; and a regular order of Corinthian pilasters and entablatures; making, altogether, a height of 75 feet. The pilasters are 4 feet 6 inches diameter, and, exclusive of the entrance portico, there must have been 120 on the outside of the four walls, or sides of the rectangular court. From the surface of the outside ground to the level of the top of the pedestal (16 feet), there is a straight stair which extends 138 feet, which is the length of the portico, consisting of ten columns. This portico projects 49 feet before the face of the wall, rises to the same height as the pilasters, and has a pediment which rises more than one-fifth of the extent. The columns next the middle have been placed nearer to those next to them, in order to render the middle space wider than the other intercolumnations. The bases are attic; the architrave has many members; the frieze is an elliptical curve, and plain; the cornice has both dentils and enriched modillions; the other members, except some lions heads in the upper member, are plain. Immediately under the portico, the boundary wall is much decorated; the center doorway is 32 feet 6 inches high, and 15 feet 9 inches wide, with highly enriched architrave, trusses, and entablature. On each side is a door 16 feet 10 inches by 8 feet 10 inches, with plain architraves, and enriched soffit, trusses, frieze, and cornice. Over each of the side doors is a nich for a statue, having two small Corinthian columns on each side, also enriched frieze and cornice, and a shell in the domical head. On both sides of each of these doors are two heights of tabernacles, formed by pilasters and enriched frieze and cornice; the tops of these are flat, and the face of the pilasters plain. Over all these parts the general entablature of the portico passes, and although plain on the external face of the portico, it is here highly enriched. Though, exclusive of the projection of the pilasters, the inclosure wall measures only about six feet in thickness; yet, at the entrance under the portico, there is a solid of about 18 feet in thickness. The inner face of this very much resembles that which has just been described under the outer portico, only that the side doors, niches, and tabernacles, have pointed pediments. Round the inside of this court-wall, there are pilasters corresponding to those on the outside, so that there must have been 112; that is, eight fewer than on the outside, not counting the one quarter at each internal angle; between each of these pilasters there has been a tabernacle for a statue. Parallel with the inside of this western inclosure wall, is a row of columns, placed 48 feet 7 inches from the face of the pilasters, and at the distance of 8 feet 3 inches from each other, making 44 in number; besides two pilasters which distinguishes the extremities of the entrance portico, and upon which there is a pediment similar to that in the outside. The shafts of the columns are plain, but the entablature is highly and beautifully enriched, the ground of the frieze is flat, the foliage upon it has a very bold relief; against each shaft, (except those of the portico,) at about one third of its height, is a bracket, apparently to receive a statue. Alongst each of the other three sides of the court, were two rows of columns, similar to those already described, placed 19 feet from the face of the pilasters upon the wall, and the same from each other in that direction. Besides the larger clustered columns at the extremities of each row, and which were 12 in number, there were 51 in each row along the north and south sides, and 56 along the east and west sides, making altogether 226, and with the clustered columns 238, which, added to those along the western or entrance side, and inner portico, make 288 insulated pillars; in the circumference of this court, and along which there passed a highly enriched and delicately sculptured entablature, without a single break, excepting a very slight one to mark the extent of the entrance portico and its pediments.

Temple of the Sun.

Court.

Number of columns within the court.

Temple.

The temple itself stood 119 feet nearer to the eastern than the western colonnade, and about 22 feet nearer the south than the north. It was raised upon a platform, and this was ascended by steps which passed quite round it; the peristyle consisted of eight columns along each end, and 15 along each side, counting those at the angles twice; the length, over the columns, measures 190 feet, the breadth 103 feet; between the face of the pilasters upon the cell, and the inside of the columns of the peristyle, the distance is 22 feet 2 inches on the sides, and 22 feet 9 inches on each end; the height of the order, exclusive of the plinth upon which each column stands, (which is 1 foot 8 inches,) is 62 feet 8 inches; the shafts are fluted; the vases of the cups are now plain, but have marks shewing that metallic leaves and volutes have been fixed upon them; the architrave has one member enriched; the frieze is flat, and enriched by festoons of flowers held by female figures with wings; the cornice has dentils and modillions, and has every member except the corona enriched. On each side the principal entrance, which is on the west side of the edifice, there is a clustered column. The dimensions of the cell are, between the pilasters at the external angles, length 133 feet 4 inches, breadth 47 feet; between the pilasters, at each end, are two semi-ionic columns. The entrance door is 33 feet high and 15 wide; the architrave has one member enriched, the frieze and cornice are fully enriched; in the soffit is a bird like an eagle with wings extended. The windows, of which there are four on each side of the cell, are 8 feet 10 inches high, 4 feet 4 inches wide at the bottom, and 4 feet 2 inches at the top; they have architraves round the sides and top, on the outside pediments, and on the inside a flat cornice; they, on both sides, stand upon plain sills; the architraves are ten inches broad. Within the cell, at each end, are divisions like those of a modern chancel for an altar table, with a stair on one side and a small vestry on the other. Over the middle spaces, the soffits or cielings are enriched by sunk moulded pannelling of square octagonal and rhomboidal forms, each having a flower in the center. In the middle part of each soffit is a large circle; round one of them are the signs of the zodiac, and within it pentagonal compartments with busts, one evidently a Mercury, and another Apollo. Round the circle of the other soffit is a very rich fret work, and a large open flower in the center.

Long portico.

Next in consequence to this magnificent court and temple, is the ruin named the long portico, said to have been distinctly traced for a distance of 4000 feet; it commences at about 1200 feet to the north west of the temple; it is composed of four rows of columns, embracing a breadth of 82 feet; that is, the space between the middle row of columns being 37 feet, and on each side 16 feet; the diameter of the columns is 3 feet 8 inches; the intercolumn lengthwise 7 feet 2 inches. At the entrance to this portico is a gateway, consisting of three arched passages, the middle is 45 feet high, and 23 feet 6 inches wide; those on each side 22 feet high, and 11 feet 6 inches wide. The external and internal façades have Corinthian pilasters, and a pediment over the middle part; the pilasters are pannelled and enriched like those at Spalatro; the frieze is covered with acorns and small leaves. The height of this order, including a plinth of three feet, measures 57 feet 6 inches. The whole has the appearance of a fine triumphal arch. It does not stand at a right angle, but in an oblique position to the general direction of the portico.

We must deny ourselves the pleasure of entering upon the description of the other numerous temples and tombs of which vestiges were discovered, and proceed to give a short account of Balbec.

Balbec.

Approach to the temple of the Sun.

Balbec had been so completely destroyed, that the vestiges of three edifices only could be traced by Messrs Dawkins and Wood, as appears by their book, published in 1757. These consist of the Temple of the Sun, with its courts; another smaller temple immediately adjacent to it; and a singular circular temple, which stood about 400 feet to the south-east of the former. The great temple is first approached by a stair, 180 feet in length, rising 24 feet, to an oblong portico of the same length, and 40 feet in depth; and this portico has, at each end, an apartment 38 feet by 31 in the clear. The façade of this noble portico consists of 12 columns in the open part, and four pilasters at each end, standing against the before-mentioned apartments. The height of the order, which is Corinthian, is 52 feet; and, besides the general basement, which, as at Palmyra, forms a regular pedestal, there is here another about three feet six inches high. The diameter of the columns is four feet three inches at the bottom, and three feet nine inches at the top, and the intercolumn is 9 feet six inches, and eleven feet and eleven feet six inches. The bases are attic; the shafts are plain; the architrave has its upper member enriched; the frieze is flat and plain; the cornice has dentils and modillions, and has the upper member enriched; there is no break over the columns, and only a very small one at the pilasters. Over the order is an attic, or rather a pedestal with its plinth, dado, and cornice, altogether about ten feet in height. In this there is a small pilaster over each column and pilaster below, and upon the top of each there is a small square plinth. The whole height of this façade is 89 feet 6 inches. Under the porch, and in the apartments at each end, there is a succession of tabernacles in two heights; the upper ones having pediments over them, alternately circular and pointed; some having the level cornice interrupted by a shell, and others, a part of the raking cornice, leaving an opening in the middle part. From under this portico there are three passage door-ways; that in the middle is 34 feet high and 17 wide; those on each side 18 feet high and 10 feet wide. These doors are surrounded on the sides and top by very broad plain architraves. The friezes are all low, flat, and plain. The cornices have plain modillions. These entrances lead into an hexagonal court, two sides of which measure 110, and the other four 88 feet each; the breadth across being 146 feet. On five sides of this singular court, there are apartments, some 60, and others 63 feet long, and 22 feet in breadth. The back and end walls are filled with tabernacles. The sides next the courts are open, and each supported by four columns, 2 feet 9 inches diameter at the bottom, and 2 feet 5 inches at the top, and having intercolumns of 9 feet 6 inches, and 9 feet 8 inches, and 8 feet 7½ inches. Between these large apartments are others in the angles, of various shapes and dimensions. The sixth side forms an entrance into a large quadrangular court, measuring 374 × 368 feet; having along three of its sides oblong apartments, similar to those in the hexagonal court, from 57 to 80 feet in length, and 22 in breadth; and there are on two sides two semicircular recesses, 32 feet diameter, with five niches in each, and having two large columns in the open sides next the court: There are also, besides, eight rectangular apartments. The columns in this court are also 2 feet 9 inches diameter, with intercolumns from 8 feet 2 inches to 8 feet 4 inches. The orders in both courts appear to be the same in form and dimensions. They stand upon insulated pedestals, five feet in height. From the top of this, the order measures 33 feet 6 inches. The shafts are all plain. The architrave has the small beads and upper members enriched. The frieze is very low: The ground of it is flat, and is decorated by short festoons of flowers, suspended upon oxes' skulls, and small masks between them, all in bold relief. The cornice has dentils and modillions, and four other members enriched. Over the order is an attic, or pedestal, with small pilasters. The niches and tabernacles are finished similar to those in the portico, with pediments, pointed, circular, and broken; and there are besides, in the niches of the semicircular recesses, some pilasters with enriched pannels and capitals, with Corinthian bases, and Ionic angular volutes, and enriched ovolo resembling the Roman composite. When the whole of those courts were perfect, it is scarcely possible to conceive any thing in Roman architecture to have been more imposing.

Hexagonal court.

Quadrangular court.

Temple.

On a line with the extremity of this quadrangular court commences the peristyle of the temple; and the situation of the columns alone can be traced, of which, very fortunately, nine remain standing, and have their entablature perfect. There are ten in front, and nineteen on the sides, counting those at the angles twice. The extreme length over the columns measures 285 feet, the breadth 157. The diameter is 7 feet at the bottom, and 6 feet 5 inches at the top. The intercolumn is from 8 feet to 8 feet 10 inches. The middle, or entrance, opening at each end, is 13 feet 9 inches. The shafts consist of three pieces, joined by iron dowels above one foot diameter. The whole height of the order, including a plinth of four feet, is 87 feet. The bases are attic; the shafts are plain; the capitals are a chaste, beautiful Corinthian, with the members of the abacus quite plain; the architrave has the small beads, and two upper members, viz. an ovolo and cavetto, enriched; the frieze is very low, the ground plain, enriched by inverted trusses, with heads and masques over each, and festoons of flowers between them fastened to the masques by ribbons. Immediately over these lies a small, but very beautiful guilochi. A small fillet and bead divides this guilochi from the dentils; and they are only divided from the modillions by an enriched ovolo. Over the modillions projects the corona, having its face enriched by a double fret; and a small fillet and twisted ribbon divides this from a large semi recta, fully enriched with the acanthus leaf, Corinthian caulicola and masques. This seems to have been as rich an entablature as could be devised; and, in order to obtain richness, elegance has been sacrificed, by annihilating the deep Greek frieze, and converting the whole entablature into a massy cornice. There are no means of knowing, whether there has been any attic placed upon this entablature. The peristyle stood upon a basement of rough masonry, which it is thought was intended to be covered by a subbasement of large square stones, like those which now form one row of a terrace, along the north and west sides.

Terrace.

The length of these stones are from 31 to 35 feet; their breadth, besides the projection of the mouldings, is 10 feet 5 inches; and their thickness is 13 feet. Our travellers could not get to measure the height and breadth of the stones which composed the second row; but they found the length of three stones to make above 190 feet, viz. 63 feet 8 inches + 64 + 63 feet.

Smaller temple.

The next object is the smaller though more perfect temple; it stands upon lower ground than the former; its length over the columns measures 222 feet, and 114 feet 7 inches in breadth, so that even this smaller temple is longer than that of Minerva Parthenon in the Acropolis at Athens. It consists of 8 columns in front, and 15 on the sides; their diameter is 6 feet 5 inches, the intercolumns 8 feet 6 inches, and 8 feet 10½ inches, and 9 feet; that of the entrance is 11 feet 6 inches. Along the front are two rows of columns, besides other two in a line with the pilasters or antæ of the porch; along the sides and the other end there is one row only; these latter stand 9 feet 8½, and 9 feet 9 inches from the wall of the cell. The height of the order, including a plinth 1 foot 9 inches, upon which each column stands, is 76 feet 6 inches, being one and a half of the height of that of the Parthenon; therefore, in point of dimensions, even this edifice commands admiration. The entablature so exactly resembles that of the great temple, that it is unnecessary to repeat the description. The pedestal, upon which the order is elevated, measures 16 feet 4 inches in height, and is ascended by a stair in front 97 feet in length, to the level of the floor of the portico and temple.

Rich soffit of the peristyle.

The soffit, or lacunari, between the columns of the peristyle and wall of the cell, all round the temple, is fully enriched with sunk and moulded pannelling, they are in hexagonal, rhomboidal, and triangular forms; those which are rhomboidal contain busts of gods and heroes; the hexagonal contains entire figures of Leda, Ganymede, &c. all cut in marble in alto relievo.

Vestibule.

In the vestibule, the distance from the inner side of the second column in front to the entrance of the cell is 50 feet; the entrance door is 41 feet high, and 21 feet 4 inches wide; the side architraves are each of one piece, and those, as well as the frieze and flat cornice, are highly and delicately enriched; the architrave is 4 feet in breadth. On each side of this doorway there is a small staircase in the middle of the wall; and in the anterior angle of the cell, at this place, there are two small portions of columns clustered together.

Interior of the cell.

Along three fourths of the length of each side there is a colonnade, but instead of being insulated or attached to the wall, there is first square projections of two feet, placed at the distance of 6 feet 7 inches from each other, upon the face of which are attached semi-columns 4 feet 1 inch diameter, which, added to the former, makes a projection of 4 feet. This order stands upon a pedestal 11 feet high, the order itself measuring 49 feet, making the whole height from the floor to the springing of the arched roof 60 feet; the columns are fluted, and also the flat frieze; the small beads and upper members of the architrave are enriched, as is the whole of the cornice. It was judged that this part of the cell had been arched with ribs, corresponding to each pillar below, springing from the top of the entablature, and having their soffits enriched by guilochi, and the spaces between the ribs by sunk moulded square pannelling. Upon the face of the wall between the columns, there are arched recesses with enriched imposts and architraves; and over these, upon a moulded bracket, stands a regular entablature and pointed pediment. At three fourths the length of the cell, there is an ascent by steps to the height of 11 feet above the level of the floor of the body of the cell.

Thalamus.

Upon this level two semi-columns, each united to a pilaster, divide off this remaining space or thalamus, which is also ornamented by smaller pilasters, some of them in two heights with arched recesses or niches between them; there is a vaulted space under this raised floor, which also descends lower than the other or general floor.

Small circular temple.

The only other remaining edifice is the small circular temple 32 feet in diameter, filled with tabernacles, of which the peculiarity is that the entablature of the lower range is continued uninterrupted round the apartment, and that in the space between these in the upper range there stand single insulated columns; over the whole there passes a full entablature, and some of the stones, which composed the arched roof, still remain. The external order stands upon a pedestal 12 feet high; the order itself, including a plinth 1 foot 9 inches, is 39 feet high; the columns are 3 feet 1 inch diameter; the floor of the temple is upon a level with the level of the top of the pedestal, and is arrived at by means of a stair 19 feet in length; here 4 columns stand in a straight line, and a small segment is cut off the edge of the circle where the entrance doorway is placed; this forms a portico 50 feet in length. The remainder of the external circumference is encompassed by five reversed semicircles, each 24 feet diameter, and upon each of the points where they meet, which is 12 feet from the face of the wall, stands a column, between which the entablature, passing in the same circular manner as the basis, forms five semicircles. Opposite to each of these columns there is a pilaster upon the wall of the cell, and between these are enriched niches upon pedestals. Under the soffit of the general entablature, the upper part of the wall of the cell, between the before mentioned pilasters, is ornamented by festoons of flowers held up by boys. The whole edifice has a very light and striking effect.

General observations.

We have entered more into detail respecting the architecture of Palmyra and Balbec, because it is of singular magnificence at this extremity of the Roman empire; and having been faithfully measured and delineated, the different edifices afford accurate and perfect specimens of the style of the age in which they were constructed. It appears nearly certain, that the temple of the Sun at Balbec was built under the Roman emperor Ælius Antoninus Pius; and not only the other temple adjacent thereto, but the court and temple of the Sun at Palmyra, having so strict a resemblance in their general forms and sculptured ornaments, that we cannot help attributing the whole to the same people and period.

Our limits not admitting of more specimens of the Roman oblong temples, we must therefore proceed to

General observations. Pantheon at Rome.

those which were of a circular form, the most celebrated of which was the Pantheon at Rome. It has been generally attributed wholly to Agrippa; but from careful research, (see Maurice's *Indian Antiquities*,) Desgodetz asserts, that the body of the edifice is of much earlier origin; and that Agrippa only new modelled and embellished the inside, and added the magnificent portico. Desgodetz, indeed, gives a Plate, shewing the state of it previous to the time of Agrippa; but the Plate and description we shall insert in this work, represent the edifice in its improved condition. Desgodetz shews no architectural orders on the outside of the circular body of the edifice; whereas, Montfaucon gives an elevation from La Freri, in which there are, first, a high basement, then a regular Corinthian order, and upon that a regular composite order. We shall, however, follow Desgodetz. The dimensions are in French feet. See Plate CLXII.

Plate CLXII. Interior dimensions.

The body of the temple is circular. The inside diameter, taken on the ground floor, exclusive of the chapel recesses, is 133 feet; the thickness of the outer wall is 19 feet $1\frac{1}{2}$ inches; making the diameter of the outer circle 171 feet 3 inches. The height from the floor to the level of the springing of the dome is 65 feet $9\frac{3}{4}$ inches. The dome being semicircular, would, if complete, rise half the diameter. The opening at the top, however, takes something from this; but is compensated in the extension of the diameter, by the upper order receding from the vertical face of that below; so that the rise may be taken at half the diameter on the ground plan, viz. 66 feet 6 inches; making the whole height from the pavement to the top 132 feet $3\frac{3}{4}$ inches, or very nearly equal to the inside diameter.

Around the lower area there are seven chapels, in the thickness of the walls, each 27 feet wide, except that opposite the great entrance, which is 28 feet $9\frac{1}{2}$ inches wide. The three on each side have each two columns in the line of the entrance; two of them are square, and the middle one circular. That opposite the entrance is also circular, with a semicircular niche head. It has no columns in it, but one projecting without the general line of the walls, opposite to the pilasters on each side of the recess. The pilasters, on the side of the six chapel recesses, are square on their plan. The line which passes through their middle tends to the centre of the temple, as do the faces of the semi-pilasters in the inner angles of the four square chapel recesses. Between each of those chapels there is a tabernacle, each with two isolated columns and pilasters behind them, supporting alternately pointed and circular pediments. In the thickness of the wall there are void spaces, three tiers over each other, vaulted like niches. The lower ones were entered from the outside of the building; these have been made to lessen the quantity of the solid work, which would otherwise have been very great.

The Corinthian fluted columns and pilasters, which compose the lower interstices, stand immediately on the pavement. They are 3 feet 5 inches diameter, and 32 feet $5\frac{5}{12}$ inches high; the entablature is 7 feet $8\frac{7}{12}$ inches; making the whole order 40 feet 2 inches. The second order stands upon a high pedestal, and has a large cornice, but the pilasters, which are composite, are slender. In this attic there are 14 windows, but the temple is lighted chiefly by the great entrance, and the circular opening at the top of the dome, which is 37 feet in diameter. The dome has 28 vertical bands, which, besides the upper and lower margins, are crossed horizontally by four bands, which composes 28 × 5 = 140 square pannels, deeply recessed by degrees or square fillets. The entablature of the upper order passes quite round the edifice without any break; and the lower entablature is only interrupted at the great entrance, and chapel recess opposite to it.

Portico.

The portico is 98 feet $4\frac{1}{8}$ inches long, between the centre and centre of the extreme or angular columns of the front, and 41 feet $5\frac{1}{2}$ inches in breadth, from the centre of the angular column to the middle of the pilaster, or antæ of the solid part of the porch. There are eight columns in front, and three deep; but eight of the inner columns are omitted, viz. four opposite the entrance, and two opposite each niche on each side of the entrance. The angular column is 4 feet $8\frac{1}{2}$ inches, and the other 4 feet $6\frac{1}{2}$ inches diameter. The middle intercolumniation is 10 feet $4\frac{3}{4}$ inches, and the next 9 feet 5 inches. The height, including base and capital, is 19 modules $16\frac{1}{2}$ parts, which, taking the module from the angle column, makes the height equal to 46 feet, and the whole order 53 feet. The soffits of the pronaus are ornamented by pannelling of different forms. The great entrance is 36 feet $1\frac{1}{2}$ inch high, and 18 feet $4\frac{1}{2}$ inches wide. The jambs are each about $\frac{1}{8}$ of the width of the door, and each worked out of two pieces. The lintel is only one piece. In the pronaus on each side of the entrance is a large niche 17 feet 10 inches diameter. Besides the 16 isolated columns, there are three fluted pilasters on each side. Upon the square solid part of the porch, which projects from the circular body of the edifice, the diminution of the columns begins at the bottom. The bases, capitals, and entablature are of white marble. The shafts are of Egyptian granite, each of one piece. The pilasters, with their bases and capitals, are of white marble. The base round the outside of the building is of marble—all the rest of brick. The inside of the temple was incrusted with marble, as was the portico.

Outside.

The circular body of the edifice is encompassed round the outside by three cornices. The top of the first is at the height of 38 feet 10 inches from the level of the upper step of the portico; from the top of the first to the top of the second cornice is 29 feet; from the top of the second to the top of the third is 26 feet $6\frac{1}{4}$ inches; these taken together make 94 feet $4\frac{1}{4}$ inches. The cornices increase in size as they ascend; the upper one being 3 feet 6 inches thick, and 3 feet $1\frac{3}{4}$ inches projection: the two upper ones have modillions cut in stone; all the rest are of brick. Above the upper cornice is a retreat of 8 feet $11\frac{3}{4}$ inches, which slopes $18\frac{1}{2}$ inches. Over this retreat is a socle or pedestal, 6 feet 9 inches high, which has a small cornice. Upon this is a retreat of 4 feet 4 inches. The degrees, or plinths, or steps of the dome, which are six in number, have a slope; their edges are rounded, and they were covered with lead. The flat part at the top, which contains the opening, is 37 feet $5\frac{2}{3}$ inches. From the top of the upper cornice there is a small stair upon the outside of the dome leading to the top. On the outside of the circular body of the edifice, there appear arches in the brickwork in two tiers vertically over the chapel recesses, and other recesses in the walls. If the cornices, which encompass the edifice, are correctly marked by Desgodetz, there is neither recess nor projection, to admit of the Corinthian and composite orders, shewn in the elevation given by Montfaucon from La Freri.

Temple of Vesta at Tivoli. Plate CLXIII.

The small circular temple of Vesta at Tivoli. (see Plate CLXIII.) about five or six leagues from Rome, is built of Tiburtine stone, except the walls, which are of flint. A row of 18 Corinthian fluted columns surrounds the cell, from the wall of which they stand 5 feet $3\frac{1}{4}$ inches distant. They are 2 feet 4 inches diameter, and, including the bases and capitals, 21 feet 10 inches high. They stand upon a pedestal 7 feet 3⅓ inches high; and, from the pavement upon which it stands to the top of the entablature, the height is 33 feet. The inside diameter of the cell is 22 feet 2 inches, and the walls are 2 feet 1⅙ inch thick. The door and windows are narrower at top than bottom.

Temple of Vesta at Rome.

The temple of Vesta, at Rome, is nearly on the same model. It is surrounded by 20 Corinthian fluted columns, 2 feet 11 inches diameter. They also stand upon a pedestal, and at the distance of 7 feet 2 inches from the outside of the wall of the cell. Their height, including the base and capital, is 31 feet 9 inches. The inside diameter of the cell is 26 feet 2 inches. The wall is 2 feet 1½ inch. The dado of the pedestal is plain, but the outside of the wall of the cell is rusticated.

Temple of Faunus at Rome. PLATE CLXIII.

The temple of Faunus at Rome, (See Plate CLXIII.) built by the Emperor Claudius upon the Celian Mount, is likewise of a circular form, but is, in many respects, different from those we have just described. The interior body of the building, which rises to a very considerable height, is supported by low coupled Ionic columns, with an entablature; upon this a solid wall is carried up to rather more than equal to the height of the before mentioned order; at this height is placed a row of windows with semicircular tops; the space within this is divided equally by a column, from the capital of which rise two small semicircular arches, having for their other abutments the jambs of the general opening. The space or spandrel between these small arches and the circumscribing general arch, is pierced by a small circular opening, composing the same sort of windows which was afterwards named Saxon, Norman, Gothic. The general wall of the building is carried above the top of the windows about double their height, where it is finished by a cornice. This circular edifice has a division across it, which is carried to the height of the outer wall; the lower part of this division is formed by two isolated Corinthian columns, and two pilasters attached to the wall; the columns are so placed, that the middle space is wider than those on each side. These columns are about once and a half the height of the Ionic column which supported the outer circular wall. Immediately from the capitals, arches are turned which support the cross wall; in this wall are five large openings with semi-circular tops; viz. two over each of the side, and one over the middle arch. Without the before mentioned Ionic columns, and at a distance equal to about half the diameter of the space they inclosed, is a row of small Corinthian columns, about three-fourths of the height of the Ionic; these are connected by semicircular arches raised immediately upon the capitals; over these arches is a solid wall, which, including the arches, is about the same height as the order. These surrounded the whole central building, and formed a series of arcades similar to those afterwards introduced into the Christian churches.

Windows resemble Gothic.

Arches spring from the top of the capitals.

Besides those we have now described, there were many others, amongst the numerous temples at Rome, which were very magnificent, as the following dimensions will testify.

Examples.

	Diameter at bottom.		Height of column, including capital and base.	
	Feet.	*Inches.*	*Feet.*	*Inches.*
The temple of Antoninus and Faustina at Rome,	4	$6\frac{7}{12}$	43	3
The temple of Jupiter Stator,	4	5¾	45	$3\frac{7}{12}$
The temple of Jupiter the Thunderer,	4	3¾	—	—
The temple of Mars the Avenger,	5	5	—	—
Basilica of Antoninus, or the temple of Mars,	4	6½	45	5½

General observations.

Although the Roman architecture differed widely, in many respects, from that of the Greek specimens we have adduced and referred to, yet it seems probable, that, from the time of the Macedonian conquest, the Greek style had gradually degenerated, and that they had introduced this debased manner among the Romans, who generally employed Greek artists, as we learn from the following reply of the Emperor Trajan to a request of Pliny the consul, to have an architect sent him from Rome to examine a bath at Claudiopolis, a city in Asia, situated near the foot of Mount Taurus. "I entirely leave it to you to advise the Claudiopolitani as you shall think proper with relation to their bath, which they have placed, it seems, in a very improper situation. As there is no province that is not furnished with men of skill and ingenuity, you cannot possibly want architects; unless you think it the shortest way to procure them from Rome, when it is generally from Greece that they come to us." *Letter* xlix.

Whether the Romans removed old columns from the Greek structures for their works at Rome, or employed workmen to quarry and prepare them in Attica, we cannot distinctly make out from the following passage of Plutarch in his life of Publicola, where speaking of the temple of Jupiter Capitolinus, which was rebuilt, for the fourth time by Domitian, "The pillars are of Pentilic marble, and the thickness was in excellent proportion to their length, when we saw them at Athens; but when they were cut and polished anew at Rome, they gained not so much in the polish as they lost in proportion, for the beauty is injured by their appearing too slender for their height." But this might arise in some measure from Plutarch, who was a Greek, having been accustomed to admire the proportions of the Greek Doric in their magnificent temples.

From the foregoing specimens and descriptions of Roman temples, it will be evident, that they, in many respects, differed widely from those of the Greeks. The great Temple of Peace was nearly of a square form; in it there were circular recesses, and a number of arched windows in the outside walls; and the whole of the interior was covered by bold and lofty vaultings; those of the great middle aisle (77 feet 5 inches in width,) were groined arches. In the temple of Fortuna Virilis at Rome, the columns, excepting those of the entrance portico, were attached to, and only projected half their diameter from, the outside of the walls of the cell. In the Pantheon, instead of a square, a circular form was adopted, and the whole covered with one great spherical vault or dome. With the exception of the grand portico, it had all the ornaments, square recesses, and circular niches for the statues of the Gods, along the inside of the external walls, which left the whole interior space entirely clear. In the temples of Vesta at Rome and Tivoli, though circular, they were encompassed each with a row of Corinthian columns, and had their insides quite plain. In the circular temple of Faunus at Rome, the exterior of the main structure was encompassed by a lower one, consisting of an arcade whose arches sprung immediately from the top of Corinthian columns. The interior of the central building was divided by a straight wall, having in its lower part an arcade similar to that before mentioned. The upper windows of the central building were not only arched, but each was divided by a small column, from which rose small arches included under the main arch, and having a circular perforation over them; thus, in many respects, not only differing from the Greek, but affording the elements of Saxon and Gothic architecture.

Pliny's villa.

Plate CLXI.

Laurentinum.

We must rest satisfied with the foregoing specimens, selected from the numerous public buildings of the Romans, which were co-extensive with their empire, and shall next proceed to give some account of their private dwellings. The engraved specimen, Plate CLXI. is from Newton's *Vitruvius*, being considered the best authority; but we shall precede even that by the description which Pliny the consul gives of his winter residence at Laurentinum, which, being distinct and particular, will afford a perfect idea of the villa of a wealthy but not extravagant Roman nobleman; it was situated seventeen miles distant from Rome. "The landscape, on all sides, is extremely diversified; the prospect in some places being confined by woods, in others extending over large and beautiful meadows, where numberless flocks of sheep and herds of cattle, which the severity of the winter has driven from the mountains, fatten in the vernal warmth of this rich pasturage. My villa is large enough to afford all desirable accommodation, without being extensive. The porch before it is plain, but not mean, through which you enter a portico in the form of the letter D, which includes a small but agreeable area. This affords a very commodious retreat in bad weather, not only as it is inclosed with windows, but particularly as it is sheltered by an extraordinary projection of roof. From the middle of this portico you pass into an inward court extremely pleasant, and from thence into a handsome hall, which runs out towards the sea; so that when there is a south-west wind, it is gently washed with the waves, which spend themselves at the foot of it. On every side of this hall there are either folding doors, or windows equally large, by which means you have a view from the front and two sides, as it were of three different seas; from the back part you see the middle of the court, the portico, and area; and by another view you look through the portico into the porch, from whence the prospect is terminated by the woods and mountains which are seen at a distance. On the left hand side of this hall, somewhat farther from the sea, lies a large drawing room, and beyond that a second of smaller size, which has one window to the rising and another to the setting sun; this has likewise a prospect of the sea, but being at a greater distance, is less incommoded by it. The angle which the projection forms with this drawing room, retains and increases the warmth of the sun; and hither my family retreat in winter to perform their exercises. It is sheltered from all winds, except those which are generally attended with clouds, so that nothing can render this place useless, but what, at the same time, destroys fair weather. Contiguous to this is a room, forming the segment of a circle, the windows of which are so placed as to receive the sun the whole day; in the walls are contained a set of cases, which contain a collection of such authors whose works can never be read too often. From hence you pass into a bed-chamber through a passage, which, being boarded and suspended, as it were, over a stove which runs underneath, tempers the heat, which it receives and conveys to all parts of this room. The remainder of this side of the house is appropriated to the use of my slaves and freedmen; but most of the apartments, however, are neat enough to receive any of my friends. In the opposite wing is a room ornamented in a very elegant taste; next to which lies another room, which, though large for a parlour, makes but a moderate dining-room. It is exceeding warm, and enlightened, not only by the direct rays of the sun, but by their reflection from the sea. Beyond is a bed-chamber, together with its antichamber, the height of which renders it cool in summer: as its being sheltered on all sides from the winds, makes it warm in winter. To this apartment another of the same sort is joined by a common wall. From thence you enter into the grand and spacious cooling room belonging to the bath. From the opposite walls of which two round basons project, sufficiently large to swim in. Contiguous to this is the perfuming room, then the sweating room, and next to that the furnace, which conveys the heat to the baths. Adjoining are the two little bathing rooms, fitted up in an elegant rather than a costly manner. Annexed to this is a warm bath, of extraordinary workmanship, wherein one may swim, and have a prospect, at the same time, of the sea, together with the beautiful villas that stand interspersed upon the coast. At the other end is a second turret, in which is a room that receives the rising and setting sun. Behind this is a large repository, near to which is a gallery of curiosities, and underneath is a spacious dining-room, where the roaring of the sea, even in a storm, is heard but faintly. It looks upon the garden, and gestatio which surrounds the garden. The gestatio is encompassed with a box-tree hedge; and, where that is decayed, with rosemary; for the box, in those parts which are sheltered by the buildings, preserves the verdure perfectly well; but when, by an open situation, it lies exposed to the spray of the sea, though at a great distance, it withers. Between the garden and this gestatio runs a shady plantation of vines, the alley of which is so soft, that you may walk barefoot upon it without injury. The garden is chiefly planted with fig and mulberry trees, to which the soil is favourable, as it is averse from all others. In this place is a banqueting-room, which, though it stands remote from the sea, enjoys a prospect nothing inferior to that view. Two apartments run round the back part of it, the windows whereof look upon the entrance of the villa, and into a very pleasant kitchen garden. From hence an inclosed portico extends, which, by its great length, you might suppose erected for the use of the public. It has a range of windows on each side; but on that which looks towards the sea, they are double the number of those next the garden. When the weather is fine and serene, these are all thrown open; but, if it blows, those on the side the wind sets are shut, while the others remain inclosed without any inconvenience. Before this portico lies a terrace, perfumed with violets, and warmed by the reflection of the sun from the portico; which, as it retains the rays, so it keeps off the north-east wind; and it is as warm on this side as it is cool on the opposite. In the same manner it proves a defence against the south-west; and thus, in short, by means of its several sides, breaks the force of the winds, from what point soever they blow. These are some of its winter advantages. They are still more considerable in summer; for at that season it throws a shade upon the terrace during all the forenoon, as it defends the gestatio, and that part of the garden which lies contiguous to it, from the afternoon sun, and casts a greater or less shade, as the day either increases or decreases; but the portico itself is then the coolest when the sun is most scorching, that is, when its rays fall directly upon the roof. To these its benefits I must not forget to add, that, by setting open the windows, the western breezes have a free draught, and by that means the inclosed air is prevented from stagnating. On the upper end of the terrace and portico stands a detached building in the garden, which I call my favourite; and indeed it is particularly so, having erected it myself. It contains a very warm winter room, one side of which looks upon the terrace, the other has a view of the sea, and both lie exposed to the sun. Through the folding-doors you see the opposite chamber, and from the windows is a prospect of the inclosed portico. On that side next the sea, and opposite to the middle wall, stands a little elegant recess, which, by means of glass doors and a curtain, is either laid open to the adjoining room, or separated from it. It contains a couch and two chairs. As you lie upon this couch, from the feet you have a prospect of the sea; if you look behind, you see the neighbouring villas; and from the head, you have a view of the woods. These three views may be either seen distinctly from so many different windows in the room, or blended together in one confused prospect. Adjoining to this is a bed-chamber, which neither the voice of the servants, the murmuring of the sea, nor even the roaring of a tempest can reach; not lightning, nor day itself, can penetrate it, unless you open the windows. This profound tranquillity is occasioned by a passage which separates the wall of the chamber from that of the garden; and thus, by means of that intervening space, every noise is precluded. Annexed to this is a small stove-room, which, by opening a little window, warms the bed-chamber to the degree of heat required. Beyond this lies a chamber and antichamber, which enjoy the sun, though obliquely indeed, from the time it rises till the afternoon. When I retire to this garden apartment, I fancy myself a hundred miles from my own house, and take particular pleasure in it at the feast of the Saturnalia, when, by the licence of that season of festivity, every other part of my villa resounds with the mirth of my domestics; thus I neither interrupt their diversions, nor they my studies. Among the pleasures and conveniences of this situation, there is one disadvantage, and that is the want of a running stream; but this defect is in a great measure supplied by wells, or rather I should call them fountains, for they rise very near the surface."

To this we shall only add the general description of a villa, given by Vitruvius. "Those of the nobles who bear the honours of magistracy, and decide the affairs of the citizens, should have a princely vestibulum, lofty atrium, and ample peristylium, with groves, and extensive ambulatories, besides libraries and basilicas, decorated in a manner similar to the magnificence of public buildings, for in these places both public affairs and private causes are oftentimes determined." Again, "these rules also are applicable not only to the city houses, but likewise to those of the country, except that in those of the city the atrium is usually near the gate, whereas in the country, pseudo urbana, the peristylium is the first, and then the atrium, having a paved porticus around, looking to the palestra and ambulatories.' (Newton's *Vitruv.* b. vi. chap. 8.) See Plate CLXI. The names being inserted in each apartment, renders the use of them apparent by inspection.

Plate CLXI.

Revival of Roman Architecture, and its present state.

St Sophia at Constantinople.

Plate CLXXIII.

The church of St Sophia, erected at Constantinople, under the emperor Justinian, about the year 637, by the Greek architects Anthemius and Isodorus, forms an intermediate link between the ancient Roman architecture, and that revived about the latter end of the 15th, and beginning of the 16th century. In Plate CLXXIII, we have given a plan and section, from which it will be seen that the outlines of this structure resemble those of the temple of Peace at Rome. It has also, like it, the windows and other openings covered by semicircular arches; but instead of having the central part covered by a groined vault, it is surmounted by a spherical dome, in the manner of the Pantheon, but differing from that edifice in rising only about one-third of its chord-line, whereas that in the Pantheon rises one half. Where columns are used in the recesses from the middle aisle, they have base-mouldings, but no square plinths under them: the upper member of their capitals has some resemblance to the Ionic, the other part seems an awkward imitation of the vase of the Corinthian. The spaces between the columns are covered by arches springing immediately from the top of the caps, as in the temple of Faunus at Rome. The faces of the large square piers are covered with rectangular pannels. But the whole details are miserably inferior to either the Greek or ancient Roman architecture; and the frequent failures which took place in attempting to construct the dome, though under the direction of the best Greek architects of the age, are proofs of the degenerate state of the art at that period. The following short account of the manner in which the architects proceeded with this dome will, we have no doubt, be satisfactory to the reader, and prove instructive to the young architect. On the angles of a square of about 115 feet, four piers were erected, and carried up to nearly the same height, where arches were turned between them. The angular spaces between the archivolts of those arches were worked up so as gradually to form a complete circle at the level of the top of the arches. Upon this circle the dome was raised. The pressure of the eastern and western arches was resisted by walls, almost solid, running north and south, two in each direction, for about 90 feet. The small semi-dome which covered the circular recesses, were intended to resist the north and south arches; but they proved insufficient, for a few months only after the dome was completed, it gave way towards the east, fell down, and carried with it the semi-dome on that side. The architect then added to the eastern piers, by filling up some vacuities, and reconstructed the dome. But the resistance at the east end was still insufficient, for before it was completed it fell a second time. He then constructed strong buttresses against the wall of a square cloister, which surrounded the central building, and from thence carried arched buttresses over the interval to the main building, and a third time raised the dome, taking care to diminish the thickness, and for lightness to make use of pumice-stone. But after all, he found it necessary to fill up the arches on the north and south sides with others of smaller dimensions.

The early Christian churches were built with a great number of columns, because those were found ready worked among the ruins of ancient edifices. When this mode of supply failed, towards the end of the 10th century, the clumsy workmen were obliged to substitute massy piers and arcades.

If we were to follow the practice of architecture as it succeeded in point of time, we ought here to introduce and describe specimens of the Gothic school; but for simplicity and distinctness, we prefer following the Roman to its revival and present state, reserving the Gothic to the latter end of this article.

Component parts of an edifice.

Previous to producing specimens of the different variations of style which have taken place in the course of the last 400 years, we shall endeavour to discuss the component parts of a building; which being generally applicable, we are unavoidably led to consider frequently as connected both with ancient and modern practice.

Foundations.

FOUNDATIONS. This term is applied to the excavation made in the ground for the base of a building. The trenches should be sunk till they arrive at firm soil or solid rock; and in large buildings, the ground should be further proved by digging pits, or boring to a considerable depth. If the ground be rather soft or loose, but tolerably firm, pieces of oak, termed sleepers, are laid across the trench, about two feet distant from each other, their lengths being about two feet more than the bottom of the intended wall, and the spaces between them is filled with dry stone rubbish or iron cinders well rammed. Over these sleepers, planks are laid to a breadth somewhat exceeding that of the masonry, and are spiked to the sleepers; and this operation must be extended to all the walls, external and internal, that the whole edifice may have an equal bearing. If the ground be very soft and loose, wooden piles must be driven to secure the planking. They should be of a sufficient length to reach the solid ground, and be driven as close together as practicable. Their thickness should vary from being about one-sixth of their length in short piles, to one-twelfth in long ones. Where the ground is generally firm, but having some soft spaces, arches may be turned over the latter. When the superstructure is to stand on narrow piers, inverted arches should be turned between; if the ground under these is loose, piles and planking must likewise be used. When the foundations are upon slanting ground, the trenches must have their bottoms cut in rectangular steps. Forced earth is unfit for foundations, and can scarcely be rendered fit by any precaution short of making a sufficient platform, connected with the original unmoved ground.

Foundations of walls.

Besides the foregoing application of the term *Foundation*, it also indicates the substructure, or bottom of a wall, which consists of one or more offsets or steps on each side of its perpendicular faces. These are denominated footings. The breadth of this substructure must be proportioned to the weight of the superstructure, and the nature of the ground. Where the texture of the soil appears to be tolerably equal and firm, and the materials of similar specific gravity, the breadth will be as the area of the vertical section passing through the line in which it is measured. For example, suppose a wall 40 feet high and 2 feet thick to have a sufficient foundation at the breadth of 3 feet, what should the breadth of the foundation be, when the wall is 60 feet high and $2\frac{1}{2}$ feet thick? By taking the proportion $40 \times 2 : 3 :: 60 \times 2\frac{1}{2}$, we shall have $5\frac{5}{8}$ feet. In stone walls, the least breadth added to that of the superstructure, is one foot. In damp situations, charcoal, sand, tarred paper, and Parker's British cement, may all be used with advantage.

Of walls.

WALLS IN GENERAL.—A wall should be able to resist a given force, acting upon it either with uniform pressure over the whole surface, or pressing partially upon certain portions. It should be capable of sustaining the pressure of vaults or roof acting along a continued abutment; or upon points, as groin vaulting; also the power of the wind acting uniformly upon the whole surface; and all these are to be ascertained by calculations which the properly qualified architect will be capable of making. He may also be assisted by referring to the theory of arches in the article BRIDGE.

Different sorts.

There are many sorts of walls: We shall first insert the substance of what has been said on the subject by Vitruvius and Palladio, and then explain the modes practised in the present day.

Plate CLXXXIX. Fig. 1.

The wall which Vitruvius names *uncertain*, is one where the stones are laid in their natural shape and dimensions, so that the size and figure of the courses are various, as at A, (see Plate CLXXXIX. Fig. 1.) Perrault calls those *inserted*, when the stones are of a determined size, and placed in a regular order like brick-work. In this sort of work the stones should be longer and shorter alternately, or their position varied, so as to break joint, tie together, and render the whole firm and close. The Greeks made their walls frequently in the manner of brick walls, with a hard stone, having the outer face of a square form, that is, of equal depth and breadth, such as B, Fig. 2; or with stones of irregular size, as C, Fig. 3. The third sort were termed *involved*, as D, Fig. 1, where the stones were even in the front, but laid irregularly. Walls were termed *cramped* when the interior was composed of rubble, or broken or pounded cement, and the outsides of squared stones tied together by iron, as at E, Fig. 4; or where the squared outside stones were occasionally connected by long stones that went through the whole thickness of the wall, as at F, Fig. 4; and sometimes these stones went only about two thirds of the thickness, having a stone overlapping it from the other side in the next course. The term *network*, or *reticulated*, was applied to work, where the stones were square in their outer faces, but laid in courses inclining to the horizon at an angle of 45°, as G, Fig. 5. This mode was much practised at Rome, but is not calculated to afford stability.

Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.

The precepts of Palladio are as follow: Net or reticulated works (A, Fig. 6.) he condemns as being unstable; but if it is to be used, he proposes to construct buttresses at the angles BB, and place transversely or longwise six courses of stones or bricks laid horizontally at the bottom CC, and in the middle three, as DD, wherever the net or reticulated work is raised six feet.

Fig. 6.

Brickwork, in walls of considerable magnitude, he directs to be constructed as at EE, Fig. 7, the rubbish lying concealed in the middle as at FF. In the bottom to have six courses of bricks of a larger size than ordinary, then to build up about three feet in height with the common-sized bricks, and upon these to bind the wall again with three courses of the larger bricks. Specimens of this mode are found in the Pantheon and baths of Dioclesian at Rome.

Fig. 7.

A third sort of walls is composed of rough pebbles out of a river, or taken from a rock, and laid irregularly in cement, as at I, Fig. 8. This should be bound by three courses of bricks at every two feet in height, as K. This kind of work is seen in the walls of Turin in Piedmont.

Fig. 8.

The fourth sort is termed *uncertain*, as L, Fig. 9; a specimen of which remains at Preneste, twenty miles from Rome.

Fig. 9.

The fifth mode is composed with squared stones, as at M, Fig. 10. It is named *pseudisodomum*, and is to be seen in the temple of Augustus at Rome.

Fig. 10.

The sixth, as at Sirmion upon the lake of Garda. They are formed by making two sides of stakes and planks, as N, Fig. 11, between which stones and mortar are thrown in promiscuously; when these have set or con-

Fig. 11.

solidated, the wooden frames are removed, and the sides of the wall appears as at O. This is termed *formaceous*.

Plate CLXXXIX. Fig. 12.

A seventh sort of work is seen in the ancient walls of Naples, where two outside walls are built of squared stones laid in regular courses, PP, Fig. 12, bound together by transverse or cross walls at certain distances, as QQ, and having the remaining spaces between these walls filled up with stones and earth.

General remarks.

The ancients bestowed great pains upon forming the beds and joints of the stones; they were frequently so fine as to escape the eye. They usually worked only at first the bed and joints, and having set the stones in this state, afterwards polished the faces.

Palladio directs, that as the wall rises above the ground, its thickness should diminish in the manner of a pyramid; that the inside face of the wall should be in a perpendicular line; that the thickness of the podium or foot of the wall, be half that of the foundation; in the middle of the wall, or front band, the thickness be diminished half a brick; at the top, or crown of the building, another half brick to be taken away; and, that some sculpture, or bas relief, should conceal outwardly the gradual diminution. That great attention should be paid to render the angles as firm as possible by means of long and hard stones; and that the openings, windows, &c. be removed, at least to the distance of their own breadth from the angles.

Modern house-building.

In modern house building, the bedding joints of the squared stones or bricks have always a horizontal position. In piers, quays, and bridges, the bedding joints are generally laid at a right angle with the latter of the outside faces; and these latter are sometimes worked in the reticulated manner, that is, the courses are laid at an angle of 45° with the horizon. But this subject will be more fully discussed under the article MASONRY.

Footings.

The footings in the foundations of stone walls should be composed of large square stones, all of the same course, being of an equal thickness. If the foundations are made to taper much, the superstructure will depend on the back parts of the lowermost stones, and unless these are very truly worked and laid, it will therefore be liable to give way. Where the direction of a wall is up the face of steep ground, cut into steps, the footings must be bedded with great care; and all the upright joints of an upper footing stone, should break joint, or fall upon the middle of the stones below. In laying the foundations of thin walls, where stones of proper size can be had, each course of the footing should consist of stones reaching the entire thickness of the walls, with the proper projections. But in thicker walls, when only a part of the stones can be had of sufficient length, then every alternate stone may be laid quite across the wall; the interval consisting of two stones in breadth after the manner of Flemish bond in brickwork. If even these bond stones cannot be procured, then every alternate stone may be in length two thirds of the thickness on one side the wall, and on the other side a stone of one third of the same breadth may be placed, and the order reversed in the next course, which will form a sufficiently strong bond. In broader foundations, where stones cannot be procured equal to two thirds of the breadth, they may be built with the joints of the upper course of each footing resting nearly on the middle of the stones in the course below it.

Disposition of materials.

ubble wall.

When the superstructure of a wall consists of unhewn stone laid in mortar, it is called a *Rubble Wall*, which may be either *coursed* or *uncoursed*; of these the latter is very common in ordinary buildings. The greater part of the stones are used as they come from the quarry; some have a slight hammer dressing. This sort of wall is very inconvenient for receiving bond timbers; but if *bond timbers* be preferred to *plugging*, the backing must be levelled in every height where the bond timbers are required. When the stones are very small, and of irregular shape, it will add to their stability to work in slender laths or old hoop iron; and care must be taken to dispose the longest sort of the stones so as to create the greatest possible bond; and the work must be carried very regularly up round every wall of the building, and with not too much rapidity, in order that it may have time to indurate or set, to a certain degree of firmness before a great weight comes upon it; and on no account should thin stones be set on edge, which thoughtless and unprincipled workmen are but too much inclined to, either from haste, or for the purpose of making a smooth out-side facing.

Plugging.

No thin stones to be set on edge.

Coursed rubble.

Coursed rubble, where proper stones can be obtained, is much preferable to the other, and is more favourable to the disposition of bond timbers. The courses are of various thicknesses, adjusted by means of a guage or sizing-rule; and the stones are either hammered, dressed, or axed.

Ashler work.

Walls faced with squared stones, and backed with rubble or brick, are called *ashler work*, and the stones themselves are called ashlers. The average size of each ashler is from 24 to 36 inches in length horizontally, 8 to 12 inches in breadth or depth, and 10 to 16 inches in height. The best figure for the stones of an ashler facing, is that of a truncated wedge, that is, thinner at one end than the other in the thickness of the wall, so that those in one course may form in their back parts indentations like the teeth of a saw, the next course having its indentations varied from that below it; the whole is therefore toothed or united with the rubble backing, much more effectually than if the backs of the ashlers were parallel with the face. Bond stones should be introduced in every course of ashler facing: they should be in quantity equal to one-sixth of the face of the wall, and of a length to reach at least one foot into the back, but the more the better. every bond stone should, if possible, be placed in the middle between those in the course below. When the jambs of piers are coursed with ashler, or when the jambs are of one entire height, every alternate stone next the aperture in the former case, and next to the jambs in the latter, should bond through the wall; and every other stone should be placed lengthwise, in each return of an angle, not less than the average length of an ashler. Bond stones should have no taper in their beds, nor should their ends, or the ends of the return stones, be ever less than 12 inches. *Closers* should never be admitted, unless they bond at least two-thirds of the thickness of the wall. All upright joints should be square or at a right angle with the face for about two inches back, after which they may widen a little towards the back. The upper and lower beds of every stone should be quite level or parallel to each other for their whole breadth. All the joints, for the distance of about one inch from the face, should be cemented with fine mortar, or with a mixture of oil-putty and white lead; the former is practised at Edinburgh, the latter at Glasgow; at the latter place the joints of the polished ashler work are uncommonly fine and accurate. Parker's British cement will probably supersede both the former. The remainder of the ashler, and all the rubble, should be laid in good lime mortar; that for the rubble should be made with coarser sand. All the stones should be laid in their natural beds. Wall plates should always be placed on a number of bond stones, to which they may be either joggled or fixed by

Bond stones.

Closers.

Jointing.

Stones laid in natural beds.

iron cramps. For more copious information, See MASONRY.

Vaults and domes.

VAULTS, DOMES, or GROINS.—A vault is an interior roof, rising in a concave direction from the walls on which it rests, either in a continued arch from side to side,—in which case the section is semicircular, or a section of a circle less than a semicircle,—or else meeting the vertex in a point, or line, as when the section is Gothic.

The concavity, or interior surface of the vault, is called the *intrados;* which, in simple vaulting, generally consists of the portion of the surface of a cylinder, cylindroid, or sphere, never exceeding half the solid; while the springing lines, from which the vault rises, and by which the walls are terminated, are generally straight, and parallel to the axis.

Denominations.

Vaults having a horizontal straight axis, are called *straight vaults;* and those with their axes horizontal are termed *horizontal vaults.*

The exterior, or convex curve of the superior surface of an arch, is called the *extrados.*

The vertical sections of the intradosses of vaults may be formed in curves of an infinite variety; but the most elegant are circular or elliptic, and have been adopted among the Romans, by some of our ancestors of the middle ages, and by the nations of modern Europe. To these, therefore, we shall at present confine our observations.

A cylindrical, or cradle vault, consists of a plain arch; the figure of whose extrados is a portion of a cylindrical surface, terminating on the top of the walls which support it, in a horizontal plane parallel to the axis of the cylinder.

A cylindroidal vault consists also of a plain arch, the figure of whose extrados springs from a horizontal plane, but its section perpendicular to those lines is every where a semiellipsis, equal and similar throughout, having its base that of either axis; otherwise, it is sometimes the segment of an ellipsis less than a semiellipsis, having an ordinate parallel to the axis for its base.

A vault, rising from a circular, elliptical, or polygonal plan, with a concavity within and a convexity without, so that all horizontal sections of the intrados may be of similar figures, having their centres in the same vertical line, or common axis, is called a *dome.*

Various names are given to domes, according to the figure of their plan, as polygonal, circular, or elliptic. Circular domes may be either spherical, spheroidal, ellipsoidal, hyperbolical, parabolical, &c. Such as rise higher than the radius of the base are called *surmounted domes,* and such as are below this altitude are termed *diminished,* or *surbased domes.* If a dome be a portion of a sphere, that is, if its base be a circle, and its vertical section through the centre of its base the segment of a circle, it is called a cupola. A spherical dome, or cupola, may be intersected by a cylindric vaulting in any direction; and the intersection will always be circular, provided the axis of the cylinder tend to the centre of the sphere, because every section of a sphere made by a plane is a circle, as is also every section of a right cylinder perpendicular to the axis. Suppose, therefore, the sphere to be cut by a plane forming a section equal to that of the cylinder, and the two sections applied together, the right line drawn from the centre of the circle, which is the section of the sphere, to the centre of such sphere, will be perpendicular to the plane of this section; and, since the axis of the cylinder is also perpendicular to the same plane, it will be in the same right line with the remainder of the radius of the sphere. From this we deduce, that, when the axis of a cylindrical vaulting is horizontal, and tends to that of a spherical vault, their intersection must be in the circumference of a circle, whose plane will be perpendicular to the horizon; and hence those beautiful sphero-cylindrical groins, so greatly and justly admired in our principal buildings.

Upon this principle, any building that has a polygonal base may be made to terminate a circle, and sustain a cupola, or cylindric wall; for, if the tops of the side walls of the polygon be brought to a level, and equal segments of circles, whether semicircles or less portions, be raised on the top, meeting in the lines of intersection of the sides of the polygon, and if the angular spaces between the circular-headed walls be made good to the level of the summit of the arches, so as to coincide with the circumference of a great circle of the sphere, they will terminate in a ring at the level of the summit of the arches, and be portions of the sphere, called by our workmen *spandrels,* and by the French *pendentives.* On the ring so formed, a cornice is usually laid, on which the cylindric wall or dome is raised.

Spandrels or penden tives.

The plans of apartments intended to be covered with cupolas, are, in general, either square or octangular. The pendentives are likewise commonly equal in number to the angles of the walls; but this is not essential, because, in polygonal plans, arches may be thrown across the angles, to double the number of the sides of the polygon, still preserving the equal sides. Over the middle of the walls, equal and similar arches may be built, that shall touch those across the angles at the bottom, and have their tops in the same level: Or, instead of walls, piers may be carried to an adequate height upon each angle of the polygon, and return upon either side of it. Archivolts may then be turned over every two adjacent piers, and the spandrels be filled in to the level of the summits of the arches or archivolts, as before, and the termination will be a circle on the inside, as already stated.

No antien penden- tives.

There do not appear any instances among the Roman buildings, of pendentives or spandrels being supported by four pillars, or by quadrangular or polygonal walls, and which support themselves on a spherical dome or a cylindrical wall. Pendentives rising from pillars, and surmounted with a dome, were originally introduced in the celebrated church of St Sophia at Constantinople. St Paul's, and St Stephen's, Walbrook, London, are beautiful specimens of this sort.

Groins de scribed.

When two or more plain vaults penetrate or intersect each other, with their summits in the same horizontal plane or level, the figure of the intrados, formed by the several branches of the vaults, is called a *groin:* In other words, a groin is a vault in which two geometrical solids may be transversely applied, one after another, so that a portion of the groin will have been in contact with the first solid, and the remainder with the second when the first is removed, and that the summit of the one may intersect that of the other. This definition will be found almost universal, as it applies not only to plain vaults intersecting each other, but also to such as are annular, or in the form of semi-cylindric rings, intersected by cylindric or cylindroidal plain vaults, whose axes tend to that of the annuli; but it does not include the species used in the chapel of Henry VII. at Westminster, and in King's College chapel at Cambridge, where, instead of the horizontal sections of the curved surfaces presenting exterior right angles, as is generally the case, they present convex arches of circles.

A property common to every kind of groins, is, that the several branches intersect and form arches of equal height upon each inclosing wall, the perpendicular surface of which is continued on both sides, till intercepted by the intrados of the arches; consequently, the upright of each wall is equal in height to that of the common apex of the arches. This forms a striking and characteristic difference between domes and groins: the latter is a branched vault, terminating in each branch against the inclosing wall; whereas the former is a vault without branches, having its curves springing from all points of the wall or walls around the bottom of its circumference, whether upon a polygonal, circular, or elliptical plan. Another property of the dome is, that all its horizontal sections are similar figures, whether made by the exterior or interior surface.

Groins are variously denominated, according to the surfaces of the geometrical bodies which form the simple vault, viz.

Rectangular groin.

When the axes of the simple vaults are in two vertical planes, crossing at right angles to each other, they form a *rectangular groin*.

When three or more simple vaults of one common height pierce each other, and form a complex vault, in such a manner that if the surfaces of the several solids of which each is formed were respectively applied, one at a time, to succeeding portions of the surface of the complex vault, each portion of the complex vault would come in contact with certain corresponding portions of the surface of each of the solids: the complex surface thus generated is called a *multangular groin*.

Multangular groin.

When the several axes of the simple vaults form equal angles around the same point, and when each of the vaults are of the same width, the surface of the solid is called an *equiangular* groin.

Equiangular groin.

Equilateral groin.

When the breadths of the cross vaults, or openings of a groined vault are equal, the groin is said to be *equilateral*.

The species of every groin, formed by the intersection of two vaults of unequal width, is denoted by two preceding words; the first ending in *o*, indicates the simple vault of the greater width, and the second terminating with *ic*, denotes the simple vault of the less width.

Thus, a cylindro-cylindric groin, is a groin in which the cylindric portion is wider than the cylindroid. In this species of groin, the section of the cylindroidic part has its lesser axis horizontally posited.

A cylindroido-cylindric groin is one which has the greater axis of the cylindroidic part horizontally posited.

When the two portions of a groin are of equal width, the groin is either cylindric or cylindroidic, accordingly as the portions are both cylinders or both cylindroids.

When one vault pierces another of less height, the angle formed at the intersection is called an arch, and its species is indicated by the two preceding words, as in groins; that ending in *o*, indicates the simple vault of the greater height, and the other ending in *ic*, denominates that of the lesser height.

A cylindro-cylindric arch, is an arch made of two cylindric portions; but the portion indicated by the word ending in *o*, is higher than the portion ending in *ic*.

A sphero-cylindric arch is that in which the spheric portion surmounts the cylindric portion, or that the principal or master vault is a sphere, and the other which perforates it a cylinder.

A cylindro-spheric arch is one in which the higher arch is a portion of a cylinder, and the other a portion of a sphere, as must be the case with a spherical headed niche in a cylindric wall, or in a cylindric vault.

Greeks did not make vaults, &c.

It does not appear that the Greeks made use of vaults or arches prior to the Roman conquest; but from that period they employed not only plain vaults with cylindrical intradosses, but also quadrilateral equal-pitched groined vaults, with cylindrical or cylindroidal intradosses, or a mixture of both, as may be observed over the passages of the theatres and gymnasia.

Dome, Roman.

The dome was invented by the Romans or Etrurians. The Pantheon, which is generally reputed to have been built by Agrippa, son in-law to Augustus, (though some writers maintain that he only added the portico), is one of the earliest remaining structures with arches: it consists of a hemispherical cavity enriched with coffers, and terminates upwards in an aperture called the *eye of the dome*. The exterior side rises from degrees or steps, placed in a sloping direction, and forming nearly a tangent to the several internal groins of the steps, presenting to the eye a truncated segment of a sphere, much less than a hemisphere. This forms the general character of the Roman dome.

Domes were of very frequent use among the Romans, as may be deduced from their groins, and the remains of their ancient edifices. But ancient Greece does not furnish a single example of a dome, if we except that which covers the monument of Lysicrates, but which being only of a single stone, may rather be deemed a lintel than a built dome.

Vitruvius observes, (Book iii. chap. 8.) that the floors of temples were frequently supported by vaults, and (book v. chap. 1.) that the roofs of basilicas were vaulted in the tortoise form, which he distinguished by the term *testudo*. This mode of vaulting is very flat, and has four curved sides springing from the four walls, approaching nearly to the form of a flat dome upon a rectangular plan.

From the remains of Roman buildings we also observe that their ceilings were vaulted over their apartments, as may be seen in the chapels of the temple of Peace, and the side apartments of Dioclesian's baths, which are furnished with vaults having cylindrical intradosses; while the great rectangular apartments, in both these edifices, are vaulted with groins. Nor is it a little remarkable that these groins are not formed by the intradosses of the vaults of the chapel, whose summits rise but a small distance above the springing of the middle groins. The piers between the chapels also have small arcades, the summits of which are considerably below the cylindrical intradosses of the side vaults; a mode to be discovered in many other buildings.

Annular vaults. Temple of Bacchus.

The Romans used annular vaults, as in the temple of Bacchus, where, as in the temple of Peace and the baths of Dioclesian, the summits of the arcades, supporting the cylindric wall and dome of the central apartment, do not intersect the annular intrados, but the convex side of the cylindric wall which supports it, consequently they do not form groins.

General observations.

The intradosses of the Roman domes, as we have already hinted, are of a semicircular section, as in the Pantheon, and the temple of Bacchus at Rome, the temple of Jupiter, and the vestibule of the palace of Dioclesian at Spalatro; while the vertical section of the extrados through the axis, exhibits a much less segment, as may be seen in the first and last of the examples quoted. The latter observation, however, only applies to edifices built prior to the reign of the emperor Justinian; after which period, from the completion of the dome of St.

Sophia at Constantinople, to the finishing of St Paul's cathedral at London, the domes are all of the surmounted kind, and approach, in a certain degree, to the proportions of spires or towers, so much affected in the middle ages. Since the labours and taste of Mr Stewart and others have revived the legitimate Grecian architecture, the contour of the ancient Roman dome has been also restored, especially in cases where the structure is ornamented with any of the orders.

In the interior of the large towers of our Gothic cathedrals, over the intersections of the cross, we find domes, rising from a square base, generally pierced with two windows over each wall, and forming beautiful groins, by their intersection with the interior domic ceiling.

Equilibrium of domes.

Though the equilibrium and pressure of domes are very different from those of ordinary arches, yet they have some common properties, as will appear from the following comparison: If, in their cylindrical or cylindroidal vaulting of uniform thickness, the tangent to the arch at the bottom be perpendicular to the horizon, the vault cannot stand; neither can it be built with a concave contour in the whole, or in any part; and to make the arch in equilibrium, whether its section be circular or elliptical, supposing the intrados to be given, the extremes must be loaded vastly high, between the extrados of the curve, which runs upward, and the tangent to the arch, which is an asymptote, rising vertically from each foot or extreme of the arch. In like manner, in thin domical vaulting of equal thickness, if the curved surface rise perpendicular from the base, the bottom will burst, let the contour be as it may.

Notwithstanding this agreement, dome vaulting differs in other particulars very essentially from the common sort; for instance, to bring the figure of a dome into proper equilibrium, after the convexity has been carried to its full extent of equilibrium around, and equidistant from the summit on the exterior, the curvature may alter into a concavity; for, since the interior circumference of the courses is less than that of the exterior, the stones cannot fall inwardly, whatever be the outward pressure, unless they be squeezed into a less compass, which is supposed impossible; consequently, they must be crushed to powder before such a vault can give way. For the same reason, a vault may be constructed, that shall be convex within, and concave outwardly, and yet be sufficiently firm. The strongest form, however, of a circular vault, intended to bear a load at the top, is that of a truncated cone, similar to Sir Christopher Wren's contrivance for supporting the stone lanthorn and exterior dome of St Paul's. In this kind of vault, the pressure is communicated in the sloping right line of the sides of the cone perpendicular to the joints, consequently the conic sides have no tendency to bend to one side more than to the other, unless it be from the gravity of the materials tending towards the axis, which is counteracted by the abutting vertical joints: A form so strong, as to be adequate to sustain or repel any force acting on its summit that we can possibly conceive.

In dome vaulting, on the contrary, the contour being convex, there is a certain load, which, if laid on the apex of the dome, must cause it to burst outwardly. The power of this load will be greater or less, according to the approximation of the contour towards, or its recession from, the chords of the arches of the two sides, or to a conic vaulting on the same base, carried up to the same altitude, and ending in the same circular course. In exemplification of this, if we begin at the keystone, and proceed downwards, from course to course, supposing a horizontal line to be a tangent at the vertex, we shall discover, that every successive coursing-joint may be made to slope so much, and, consequently, the pressure of the archstones of any course towards the axis may be so great, as to be more than sufficient to resist the weight of all the part above; hence it is evident, that a certain degree of curvature may be given to the contour, which will be just sufficient to prevent the stones, in any succeeding course, from being forced outwardly.

A circular vault, thus balanced, is what is called an *equilibrated dome*; but it is the weakest of all vaults, between that of its own contour, and that of a cone upon the same base, rising to the same height, and ending in a key-stone, or finished with an equal circular course.

Boldest contour.

From these data we may conclude, that the equilibrated dome has the boldest contour, but is only the limit of an indefinite number of inscribed circular vaults, all stronger than itself.

In other respects circular vaulting differs from the straight, in being built with courses in circular rings; so that the stones in each course being of equal length, and pressing equally towards the axis, cannot slide inwardly. Hence circular vaults may be left open at the top, and even the equilibrated dome may carry a lantern of equal gravity with the part that would have been necessary to complete the whole. But domes of a more flat contour may carry more, according as they approach nearer to a cone, as already remarked; and those circular vaults that are either straight or concave on the sides, may be loaded without limit, and can never fail till the materials are crushed, provided they be hooped at the bottom. For a more complete investigation of this important subject, see DOME.

Arches.

We have already observed, that, from the earliest periods of Roman architecture, ARCHES have been of importance, and have been extensively used in the construction of most sorts of edifices; but, as their nature and principles have been treated of at some length under the term BRIDGE, we shall at present only observe, that they are introduced to cover openings to which lintels are inadequate, as drains and inverted arches in foundations, in vaulting over cellars, halls, and passages; also over doors, windows, and recesses. They are, indeed, become so generally useful, and are capable of so nice and accurate adjustment, that we cannot too earnestly press upon the young architect, the propriety of rendering their principles and practice perfectly familiar to his mind.

Balusters.

BALUSTERS are sometimes of real use, as in stairs, windows, terraces, and on the sides of passages open on one or both sides. At other times they are merely ornamental, as when terminating the upper part of the front of a building, as a screen to conceal the whole or part of a roof, or as a finish to insulated triumphal arches or gateways. They consist of short pillars, of a peculiar outline, standing upon a socle or plinth, and covered with a small cornice. No remains of balusters have been found in any ancient buildings. In the theatres and amphitheatres of the Romans, the pedestals of the upper orders were always continued through the arcades, and served as parapets. The lower seats, next to the arena in the amphitheatres, and those next the orchestra in the theatres, were guarded by a parapet called the podium. The top of the monument of Lysicrates at Athens is finished with a sort of parapet or ledge, composed of honey suckles, solid behind, and open between every pier. Each plant is bordered with a curved head, and the bottom of every interval with an inverted curve. By impressions met with on coins, we are led to suppose, that terminations of the same kind were adopted in other Grecian edifices. Balustrades are represented in the works of the earliest Italian writers, who might have seen them in the ruins of Roman structures; but none have been discovered in modern times. When a balustrade finishes a building where an order is employed, its height should be proportioned to that of the order it accompanies, and must be raised on a socle or plinth, so that its parts may be completely seen at a proper distance. When intended for service, it should be of equal height to a parapet in a similar situation, that is to say, not less than three, and not more than four feet six inches. In shape, the baluster consists of a square plinth, base mouldings, an ogee-shaped contour of body or middle part, an astragal and cup, consisting of a moulding under a square abacus. The plinth of the base, the swell of the body, and abacus of the capital, are generally in the same vertical straight line. The distance between the balusters should not exceed half the breadth of the plinth, nor be less than one-third. On stairs and inclined planes, the same proportions are to be observed as on horizontal surfaces. Formerly the mouldings were made to follow the inclination of the plane; but this is unpleasant to the eye, and is difficult in the execution; indeed, in situations of this kind, the use of balusters have been generally superseded by ornamental cast-iron work. The breadth of the balusters over an order, must be regulated by the heads of the shaft of the column, to which the die of the plinth, the bulk of the body, and the abacus, must be equal. When there is no order, the breadth of the die of the pedestal is never more than its height, and frequently less. The die of the pedestal is frequently flanked by half dies, particularly when the range is long.

Doors.
Plate
CLXXXVIII.

Doors, (see Plate CLXXXVIII.) in exterior walls, form apertures to gain an entrance into the buildings, or in interior walls for passing into apartments, or from one apartment into another. The former are again distinguished by the terms *door* and *gate*; a door is for the admission of men, a gate for horses and carriages; and as well as to houses, are inlets to cities, fortresses, parks, gardens, &c. Doors being of small dimensions, are commonly parallelograms, either arched or covered horizontally with lintels; gates being wider, are, unless they consist of piers only, always covered with arches. The general proportions for the apertures of both gates and doors, is, that the height be about double the breadth.

For doors, the minimum apertures are regulated that a man may pass easily through them; they are, therefore, seldom less than three feet wide, and six feet six inches high; but they are often varied in their dimensions, according to the height of the story and magnitude of the edifice. In private houses, four feet may be their greatest width; in churches, &c. they are frequently six feet in width. In gates, 8½ or 9 feet is the least admissible breadth; they are frequently from 10 to 12 feet.

Vitruvius, in his fourth book, has laid down rules for Doric, Ionic, and Attic doors, all of which have their apertures narrower at the top than the bottom; in these, the doors, when opened, shut of themselves; and also in opening, rise so as to clear a carpet, &c. These have also been partially introduced by modern architects, though this advantage is more generally obtained by other means.

It is a good proportion in small doors, to have their dimensions in the ratio of three to seven; and in large doors, of one to two. Inside doors must be regulated by the height of the apartment to which they belong; there is, however, a limit in this respect, because the difficulty of opening and shutting is increased by its weight; and therefore single doors of private houses should not exceed three feet six inches in breadth. The lintels of doors should be on the same level with those of windows. But in magnificent houses, where all the doors are frequently thrown open, they may be from six to eight feet, made in two leaves or divisions: here the proportion will be less in height when compared to the breadth. The apertures of exterior doors, placed in blank arcades, have their lintels usually on a level with the imposts or springing of the arch.

Principal door.

The principal entrance door ought to be in the middle of the length of the building; it divides the mass of front into more uniform portions; and the hall, vestibule, &c. are thereby placed in the centre of the apartments, to which they will have more convenient access, than if placed in any other situation. The doors which communicate between principal apartments, should be placed sufficiently distant from the side walls, to admit of furniture being placed there conveniently; for preserving an uniform temperature in apartments, there should be double doors, that is, two in the thickness of the partition wall.

Decorations.

For decorations to doorways, it is usual to have an architrave up each side, and along the top; and upon this is sometimes placed a frieze and cornice; the ends of the cornice are occasionally supported with trusses or consols, which stand upon the top of a pilaster. When the pilasters have bases and capitals, the projections are always kept within that of the architrave; the architrave over the capitals of the pilasters is similar to that of the door. Columns of some of the regular orders are sometimes introduced, supporting a regular entablature and pediments; but these, though proper enough for exterior, can scarcely be reckoned suitable for those that are between interior apartments. Outside doors are also frequently ornamented by rustic work; but rustics being imitations of the unfinished work of the ancients, appear improper when applied as ornamental. Doorways are also, in these northern climates, made in close porches, constructed in the shape of a part of a small Greek or Roman temple. When they are of a rectangular form, they admit of a doorway, with sufficient regularity and conveniency; but when circular, there is some trouble attending them; because, unless the door is also circular, it cuts off a segment, which creates an awkward appearance; and, upon the whole, we will venture to affirm, that although doorways are highly susceptible of decoration, yet the ingenious architect may contrive some much more suitable than any of the Greek orders; which being here so diminutive, are totally divested of that dignity which is necessary to produce a striking effect.

Door itself.

The door itself is either framed, battened, or ledged, and the materials are wood or metal. Formerly, in England, the doors were made of oak; in most houses they are now made of deal, and in some cases of mahogany; for strong closets for books, writings, money, jewels, plate, &c. the doors are made of cast iron. The ancients frequently constructed the doors of their temples of gold, silver, bronze, ivory, &c. As the particulars respecting the modes of preparing and framing doors belong to Joinery, the reader will, under that term, find it defined and illustrated.

Windows.
Plates
CLXXXVII.
CLXXXVIII.

In Windows, (see Plates CLXXXVII. and CLXXXVIII.), the size of the apertures depends chiefly on the circumstances of climate, aspect, proportion, and

Upper windows should be tallest.

destination of apartments; the thickness of the walls, and the number and distribution of the windows themselves. Much also has hitherto depended upon the fashion of the times; from the small proportion of ancient aperture until the slender masonry of the walls of Gothic edifices became merely frames for receiving the glass. In modern structures, where rectangular forms are employed, the breadth of the apertures serves to regulate that of the piers, though considerable latitude has been taken; yet, in plain walls, the most general practice limits the breadth of piers to be the same, or one and a half that of the aperture; the former, when circumstances admit, appears the most perfect; but these proportions must, of course, be occasionally varied, to admit of external and internal decorations. The sills of windows should be placed at a height above the level of the floor, to form a convenient parapet, but not obstruct the view; and this is varied from two feet and a half to three feet and a half. In elegant apartments, the sills are frequently on a level with the floor, or a step or two above it; in the latter case, the heights of the apertures are made more than double their breadth. It is common in different stories to have different heights, decreasing in the upper stories, until in attics they are made under a single square; this, when economy leads to making the upper stories very low, is unavoidable; but when elegance of external appearance is studied, the upper windows should be made the tallest. Windows ought to be placed vertically above each other, and not too near the angles of the building. Where the walls are thick, their jambs may be splayed or bevelled; that is, to make an acute angle with the front line, in order to admit more light into the apartments. In northern climates, sky lights ought, as much as possible, to be avoided, as being liable to admit cold air, rain, and snow. Where they are necessary to light halls and staircases placed in the central parts of the structure, the architect would do well to contrive that the lights be fixed in a perpendicular direction, and be properly protected on the top. An odd number of windows in the same front is preferable to an even number; for as it is requisite to have the entrance-door in the middle of the length, an even number, regularly disposed, would cause a pier to be over the doorway, which is inadmissible. An odd number is also preferable in a large apartment, as a pier would cast a gloom in the middle part of the floor. In edifices of importance, windows are usually ornamented in the same manner as doors, and subject to similar observations. If attics are introduced, instead of leaving the windows, as has hitherto been the practice, plainer than those below, they should, in our opinion, be rendered a part of an ornamental member, to be continued along the upper part of the whole line of front. Mixtures of windows of different shapes is in general to be avoided; but if a Venetian window is to be introduced, it should be insulated by a break or some other device; the entablature should be continued along the top of the pillars which form the divisions, and that even if an arched opening be necessary over it. In winter apartments in cold countries, two sets of sashes are placed in the thickness of the walls. The mode of preparing, constructing, and fixing the frames, sashes, linings, shutters, and dressings, will be detailed in the article JOINERY.

Chimneys. PLATE CXC.

A CHIMNEY (See Plate CXC.) consists of an aperture in the wall, to receive a stove or grate, with fire to heat the apartment; and on this account it is also named a *Fire-place*. From it a vacant space, named a vent, shaft, or flue, is carried, within the thickness of the wall, to the level of the top of the roof, to convey away the smoke. The bottom of the fire-place should be laid with square tiles, stone, marble, or an iron plate, in order to receive the cinders and ashes; this is termed the *Inner hearth*. Upon a level with this, or a little above it, and immediately before the fire-place, a space equal in length to the breadth of the chimney, and about two feet in breadth, should be laid with the same sort of materials as the inner hearth; it is termed the *Slab*, and is laid either in a wooden boxing, containing sand and mortar, or upon a flat brick arch, which has been turned between the wall and a trimming-joist in the floor. The front and vertical sides of the chimney aperture are termed *Jambs*, and are composed of stone, marble, wood, or iron. The part which reaches across the top of the aperture is called the *Mantle*, and is of the same sort of materials as the jambs. As in thin walls, the part which the chimney occupies is projected into the room, in this, what is over the chimney, is termed the *Breast*. Within the fire-place, the parts which reach between the jambs and back, are named *Covings*. Where the space is contracted from the size of the fire-place to that of the flue, it is called the *Gathering wings*, or *Throat*. The portion of the chimney which rises above the roof, is named the *Chimney top*. Where several flues, either in the wall or at the top, approach very near each other, the partitions between them are named *Withs*; and the whole is termed a *Stack*. In rooms of ordinary dimensions, the flues, in rough stone walls, are from 12 to 14 inches square; in hewn stone or brick-work, about 10 by 14 inches; but the section must be enlarged in rooms of large dimensions, kitchens, &c. As soot is apt to gather in the angles of square flues, the circular form is preferable. They should be made quite smooth within, and free of quick bendings. It is of advantage to have the flues a great height; but if raised much above the level of the roof, it is difficult to render them ornamental. Inigo Jones is the only British architect who has performed it with success.

As much of the comfort of an apartment depends upon its being free of smoke, and much economy in causing the heat to be reflected into the room, instead of suffering it to be unnecessarily absorbed by the materials, or dissipated in the flue, &c. great attention is necessary in fitting up the fire-place. For economy, stone which will stand the fire, is preferable to metal. The side covings should be levelled, or wholly circular; and the opening at the back of the fire-place into the throat should not exceed four inches in breadth; frequently one inch and a half is sufficient. With register-stoves this can be regulated to great advantage. The throat part should fall back from this aperture, and, in general, no air should be admitted into the throat, but what passes over the fire; it is therefore advisable to fit up the fire-place very accurately, and place the front of the grate forward to the line of the face of the wall of the apartment. In countries where stoves are used, it is customary to place them altogether before the face of the wall. This admits of much decoration, and also throws the greatest part of the heat into the room.

Chimneys have always been considered important features, but the style of decoration has varied greatly in different ages. In the Norman castles, they were frequently large, and accompanied by rude pillars, sculptures, and ornamented mouldings. After the revival of Roman architecture, the whole space between the fire-place and the ceilings, called the chimney breast, was covered with architectural decorations of great labour and expence. Wood was succeded by stucco work and ornamented pannels, to receive paintings; but of late these have been abandoned, and the chimney has been reduced into the smallest possible bounds, making it, for elegance, depend upon the marble dressings and highly polished and engraved steel register stoves.

Ceiling.

Plate CXC.

The name of *ceiling* (see Plate CXC.) is given to the work which conceals the naked timbers of the roof of an apartment. The Normans generally left the framing timbers uncovered, and ornamented them with mouldings and sculptures; but however much ornamented, they, in that state, always retained the name of roof. The Romans covered their roofs, and it is from the remains of their public buildings, that the moderns, after the revival of that style, derived their manner of constructing ceilings. Ceilings are either *flat*, or *coved*, or partake of both. Flat ceilings are divided into large compartments, ornamented with foliage or other devices. Coved ceilings have their sections either less than, or equal to semicircles. Ceilings which are *flat* and *coved*, are of modern invention; they have their middle part flat, and that next the walls coved. Compartment ceilings are constructed either by raising the mouldings above the general surface, or by sinking the pannels below it; or they may be partly raised and partly sunk. Amongst the ancients we find the pannels in squares, hexagons, and octagons; triangles were rarely used.

Temple of Peace.

Balbec.

In the porticos of ancient temples the ceilings were mostly divided into equilateral equiangular parts; the pannels were deeply recessed, and the prominent surfaces represent the antique method of framing the beams of floors; the mouldings, on the sides of the pannels, were sunk like inverted steps, in one or more degrees frequently enriched, and the bottom of the pannels, in general, decorated with roses. In Roman works, the pannels are always parallel, or of equal breadth, which admits of no other variety, when squares are introduced; but hexagons will join with each other, or the interstices will form lozenges or equilateral triangles; octagons form two varieties, viz. that of their own figure, and that of the square in their interstices. This sort of compartment is termed *coffering*, and the recessed parts are called *coffers*, which are used in vaulted or plain ceilings. The borders of the coffering is generally terminated by belts charged with foliage, and bordered with guillochis, as in the Temple of Peace at Rome. In the ceiling of the Temple of Balbec, coffers are disposed around the cylindrical vaults in rows, one row rising over each intercolumn; and a projecting belt ornamented with a guillochi between every row of coffers, corresponding to two semi attached columns in the same vertical plane, which support the springing of the belt. This practice has been imitated by the moderns, in cupolas and cradle vaults; the latter decorated by frets, guillochi, foliage, small pannels with roses, and large pannels with historical subjects, frequently in bold relief.

Ceilings painted.

The grounds of compartment ceilings may be gilt, and the ornaments white, party coloured, or streaked with gold; or *vice versa*, the ornaments may be gilt, and the grounds white pearl, straw coloured, blue, or any tint that will suit the ornaments. In some cases, the ceilings are either painted wholly, or in various compartments only.

General remarks.

The mode of constructing the modern ceilings having been copied from the remains of ancient public buildings, it, in general, proved too heavy for the apartments of private dwellings. This defect was first remedied by the delicate taste of Mr Adam, who introduced a much lighter style, more diversified, and better suited to private apartments. The pannels were formed by slender mouldings, the decorations of elegant stucco ornaments, or painted devices; and the whole grounds also painted to relieve the other decorations.

Stairs.

STAIRS form the means of communication between the different stories. They are regulated in height and breadth so as to render the step commodious, and the length is suited to the magnitude of the edifice and the purpose to which it is to be appropriated. The average height is about six inches, the breadth 12 inches, and the length is seldom less than three feet, generally more. The space in which the steps are inclosed, is termed *staircase*, and is square, circular, elliptical, or triangular, but rarely polygonal. The steps may be constructed of *marble, freestone, wood*, &c.; they may be supported at both ends, or at one only; when the latter, it is usually the broadest, though in small wooden stairs, the steps are sometimes made to project from a newel to which the narrow ends are fixed.

In the construction of stone stairs, supported at each end, the inner end of the steps may either be fixed into a solid newel, or be tailed into a wall surrounding an open one; or where elegance is not an object, if the newel do not exceed two feet and a half, the steps may be supported by a solid pillar, though when the newel is thicker, it will be cheaper to surround the open space with a thin wall. In stairs of a sunk story, where there is a geometrical stair above, the steps, next the newel, are generally supported on a dwarf wall.

Geometrical.

Geometrical stairs have their outer ends fixed in the wall, and the under edge of every step supported by the edge of the one below it; being constructed with *sally* formed joints, so as to prevent them from descending in either the inclined direction of the stairs, or in a vertical direction. The upper *sally* of every step forms an interior obtuse angle, called a *back rebate*, and the lower *sally* forms an exterior one; the joint occasioned by these *sallies*, is called a *joggle*. The upper part of the joint may be level from the face of the riser to about one inch within the joint; the plane of the tread of each step is thus continued about an inch within the surface of each riser; the lower part of the joint has a narrow surface perpendicular to the rake of the stair at the end next the newel. In stairs, constructed of most kinds of stone, the thickness of every step, at the thinnest part of the end next the newel, need not exceed two inches, for steps of four feet in length, measuring from the interior angle of every step perpendicular to the inclination. Their thickness at the interior angle should be proportioned to their length; allowing two inches for the thickness of the internal angle at four feet; the thickness of every other stair, at the same place, will be equal in inches to half the length in feet; thus, a step five feet long will require to be two and a half inches in thickness at the interior angle.

Stone platforms, or half or quarter spaces, of geometrical stairs, consist of one or more stones, as they can be procured; when two or more are used, the first stone should be laid upon the upper step, with its edge wedged into the wall; the next stone must be joggled or rebated into the one just set, and its end also fixed in the wall. The same mode must be pursued with the remaining stones, till the platform is completed. In cases where a second flight of stairs is required, the last stone of the platform becomes an abutment for the lower step of the next flight, and the joints must be joggled as in the former flight.

Geometrical stairs, constructed of stone, depend upon the following principle: that every body must be supported by three points at least, placed out of a straight line; and consequently, if two edges of a body, in different directions, be secured, they will become relatively immoveable; such is the case in a geometrical stair; one end of the step is always tailed into the wall, and one edge rests either on the ground or on the edge of the inferior step or platform.

Wooden stairs.

The practice of *wooden stairs,* (which also includes the constructing and fixing the handrails for those of stone,) falls under the article JOINERY, to which we must refer. But besides the before mentioned materials, stairs may be constructed with *cast iron,* which would, in the case of fire, have advantages over either of the former. The facility with which the several parts may be cast and fixed, and the light and elegant forms which may be introduced, at a comparatively moderate expence, lead us to press this new mode upon the attention of the young architect.

Cast iron.

The staircase has always been considered a principal feature, not only in the private dwelling, but also in the public edifice. It is usually placed so as to be seen from the hall or vestibule, and centrical for communicating with the public or principal apartments; it is frequently decorated with columns and pilasters on the sundry landings; it is generally terminated at the top by an elegant skylight window, and has its walls enriched with pannels for paintings, and niches for statues or busts.

Decorations.

Egypt.

DECORATIONS anciently, (besides what belonged to the orders,) consisted of sculpture and painting. In the palaces and temples of Upper Egypt, the walls are completely covered with sculptures, and the ceilings by paintings. In the numerous splendid tombs both the walls and ceilings are frequently covered with paintings; but here it is profusion rather than design or execution which attracts admiration. In the ruins of the palace of Persepolis, and tombs of the kings, the sculpture is equally profuse, and the execution just as imperfect. The fine genius and taste of the Greeks reformed both sculpture and painting. Their principal and boldest features consisted of animal figures, and it is difficult to determine whether the taste in designing or skill in the execution merits most admiration. The subordinate members are decorated with representations of vegetable substances; where great delicacy is observable, they are generally in low bass relief, and the honeysuckle plant predominates. Their paintings were chiefly historical subjects, as the battle of Marathon, by the brother of Phidias, in the temple of Jupiter Olympus at Elis. In Roman architecture the profusion of sculpture became excessive; the skill of the workmen long continued very perfect, but the taste of the architect greatly degenerated. Some of their triumphal arches and historical columns, where the utmost efforts of sculpture are appropriate, have through every age continued to command the admiration of mankind; but in their later temples, palaces, and baths, the profusion is tiresome and disgusting. In modern times, although architecture was, for some ages, overloaded with minute sculptures, it was by degrees much chastened, and excepting on interior stucco work, it has, for some time past, been almost wholly abandoned. On the other hand, the use of painting has been much extended, and is, indeed, in all interior works become universal, excepting where the walls are covered with *paper,* a modern invention of great beauty, comfort, and economy.

Persepolis.

Greeks.

Romans very profuse.

Statue or bust.

One species of sculpture has been uniformly practised by both ancients and moderns, that is the isolated *statue* or *bust.* The ancients decorated their forums, basilicas, temples, theatres, and baths, with statues of their deities, philosophers, heroes, legislators, &c. and the moderns have done the same thing in their churches, palaces, houses, squares, gardens, public walks, &c. The statues are placed either singly or in groupes; they are either raised on pedestals standing quite isolated, or in recesses termed *niches;* if in niches, the distance between the outside of the statue and the sides of the niche should never be less than one third, nor more than one half a head. Statues are frequently placed on a *plinth,* whose height may vary from one third to one half a head. Besides the before mentioned situations, statues are sometimes placed before the dwarf pilasters of attic stories, as in the arch of Constantine, the Corinthian colonnade at Thessalonica, and at Somerset Place in London.

Plan.

PLAN, by this term is understood the drawings or representations of the intended structure; they consist of three sorts: 1st, Shewing the shape, dimensions, and relative situation of the several apartments. 2d, Shewing the appearance which the external faces of the edifice will have when completed; and 3d, Sections shewing the heights and mode of finishing the principal apartments.

It will be readily perceived, that no fixed rules can be laid down for forming plans which shall, in all cases, be applicable. The architect, in making the design, must be regulated by the climate, the situation, the purpose to which the edifice is to be appropriated, the nature of the materials to be employed, and the customs and habits of the people; and the latter not only vary with their rank in society, but are continually changing in every rank, as must be evident to the reader from perusing the sketch we have given of the history of architecture. The utmost therefore we shall attempt, will be to produce and explain specimens from the works of the most celebrated architects, since the revival of Roman architecture; and make some general observations upon the modes now practised in Britain.

Revival of Roman architecture.

Buscheto.

In tracing the progress of the revival of Roman architecture, it is necessary to remark, that in 1016, Buscheto, a Greek of the isle of Dulichio, was employed to construct the cathedral of Pisa, which he did with marble columns and a dome. He had many disciples, and may be reckoned the founder of modern architecture in Italy. But the earliest specimen we shall produce, is the plan and section of the cathedral of Santa Maria del Fiora at Florence, which will be found in Plate CLXXIII. It was begun in 1288, by Arnolf Lusii, a Florentine architect, and left, after he died in 1300, for 120 years in an unfinished state, as no person could be found who would undertake to construct the dome. In 1420, Filipo Brunelleschi, having previously, with great diligence, studied the remains of ancient architecture at Rome and Florence, proposed a scheme to complete that difficult work. He solicited the curators of the fabric to have it examined by a convocation of Italian and Oltramonte architects, who complied with his requisition; but these timid artists considered the project so extravagant, that they hissed him out of the assembly. They proposed to raise a mound of earth interspersed with pieces of money, and on its top, when properly moulded, to turn the dome, and then to suffer the populace to remove the earth for the money it contained. This miserable expedient was, however, rejected; and the persevering Brunelleschi, after having returned to Rome, and again examined its ancient buildings, was recalled, and permitted, after making some experiments upon a small scale, to commence his favourite project. He continued to direct the works for 20 years, and, before his death in 1440, had closed in the dome at the foundation of the cupola or lanthern, for which, and the globe and cross, he left de-

Santa Maria del Fioro at Florence.

PLATE CLXXIII.

Brunelleschi.

signs and instructions, and which were finished in 1456. From the pavement to the bottom of the cupola the height is 277 feet, the diameter of the dome is 133 feet, and it rises about four-fifths of this diameter. It is of an octagonal form, and consists of two shells with a space between them, the tapering being very gradual. It was built without the aid of scaffolding. We have no account of the manner in which the two shells were connected, or what security it derived from *hooping*, though it is probable that precautions of this nature were adopted, after the practicability of the scheme had been so strongly disputed. The complete success, however, had acquired the architect so much respect, that he was interred within the edifice, and honoured with a public funeral. The general outline of the cathedral is in the form of a Latin cross. The nave and side aisles, which are divided by large piers, taken together, compose a parallelogram; the terminations of the transept and chancel are externally semi-octagons. These, by diminishing as they ascend, and having their vaulted roofs abutting against the sides of the walls which bear the dome, are judicious supports, and contain the elements of the flying buttresses afterwards adopted in Gothic structures. The neck of the dome rising perpendicularly for upwards of 50 feet above the top of these vaults, the interior of the dome and space below, are from thence lighted by means of a circular window placed in each side of the octagon, at about half the before mentioned height; this prevents the necessity of their being placed in the dome, and thereby destroying the simplicity of its outlines.

St Peter's at Rome.

Plate CLXXIV.

The next specimen we have selected, is the cathedral of St Peter's at Rome, erected in place of that which had been built by Constantine, in 324, upon the circus of Nero: A plan and elevation will be found in Plate CLXXIV. This is not only the most magnificent Christian temple, but in magnitude of outlines, and variety of parts, far exceeds any of the edifices constructed by the Greeks or Romans; and although the ground plan does not occupy a space quite equal in extent to that of Karnac, in the Egyptian Thebaid, yet the having about six times its elevation, gives to the Christian temple a decided superiority. The extreme length of St Peter's is 720 feet; the breadth 510 feet; and the height from the pavement to the top of the cross, 500 feet.

Bramante.

Baldassar Peruzzi.

Michael Angelo.

The design was made by Bramante of Urbino, in consequence of directions from Pope Julius II.; this pontiff having resolved to pull down the old church, and in its place to construct another to surpass every thing of the kind then extant. The architect, zealous to accomplish so magnificent a project, formed various designs, especially one, in which the front was placed between two steeples, and with a dome resembling that of the Pantheon, both externally and internally, as represented in medals made by the celebrated Caradossa, and struck under Julius II. and Leo X. But the insulated temple built by Bramante without the walls of Todi, in the duchy of Spoleto, in the form of a Greek cross, with a beautiful cupola in the middle, appears to have been the model of St Peter's. This great work was begun with much zeal and industry in 1506, but suffered a serious interruption by the death of both the Pope and architect, which took place in 1514. The work was however resumed and continued, under the direction of twelve architects, for 135 years. The plan was considerably varied under Leo. X. by Baldassar Peruzzi; and many parts of the elevation, and the whole of the dome and cupola, as executed, were designed by the celebrated Michael Angelo Buonarotti. This edifice, therefore, contains the best specimens of design of the ablest architects who flourished during a period in which the revived Roman style was carried to the highest perfection which it reached in Italy. A full description of this magnificent edifice will be found in the superb work of Carlo Fontano; the plan and elevation we have given being carefully and minutely made, will afford a distinct idea of the style and arrangement, both externally and internally. We shall therefore here confine ourselves to some general observations respecting them.

Great entrance resembles the Temple of Peace.

Interior well disposed.

Dome.

In the plan the great western entrance bears some resemblance to that of the Temple of Peace, having seven passages into a porch 230 feet long and 40 feet wide; the areas of the nave, choir, and transept, form a perfect Latin cross; the space which encompasses the plan of the dome, with its supporting piers, forms a square, having a small circle at each angle, the whole being admirably disposed for simplicity, strength, and magnificence; the side aisles, instead of being each of consequence when taken lengthwise, seem rather to consist of a number of distinct chapels, ranged along each side of the nave; but the whole interior of the fabric is so completely occupied by pilasters, columns, recesses, and niches, that nothing is left imperfect; and the breadth of the ground plan being so great in proportion to its length, conveys an idea of stability. The dome forms nearly an ellipsoid on the exterior, rising vertically from the base, and at about the height of 50 feet branches into two thin vaults, separating gradually as they rise; thin partitions are dove-tailed into each shell to connect the two together, so that the whole is rendered at once light and firm.

External outlines.

Externally in the elevation, as viewed from the westward, the height to the summit of the dome, (which includes the apparent mass of building) exceeding only in a small degree the breadth of the western façade, and the height to the top of the cross bearing the same relation to the bread that the transept does, bring the outlines of the whole mass nearly within an equilateral triangle, and thereby convey an idea of stability, equal to the before mentioned proportions of the general plan.

General remarks.

A building composed of columns and pilasters 9 feet diameter, and the whole order upwards of 100 feet high upon a façade of 400 feet, and of nearly double that extent when taken in perspective as far as the transept, is certainly one of the most imposing objects which art has accomplished; a dome resting upon a pedestal, encompassed by a colonnade 50 feet high, having its base elevated 200 feet above the surface of the earth, also commands an equal degree of admiration; for the extent of the outlines rivals the Egyptian pyramid, and the skill displayed in the construction far exceeds any thing connected with these enormous heaps of almost rude stones. But while we admit, in the fullest manner, the merits of this magnificent work, we consider it our duty to notice defects, which appear to lessen the effect which it might have produced.

Defects.

Too many breaks.

To those accustomed to examine the outlines of the façade of the Greek temple, the portico of the Pantheon at Rome, or of the square house at Nismes in France, and who have considered the associations they produce upon the principles so justly defined by Mr Alison in his *Essay upon Taste*, it will be evident, that the multiplicity of breaks in the western façade destroy the simplicity of the horizontal lines of the entablature, which ought to represent wooden beams; the mind is perplexed in determining how timber could be worked or connected in this manner, and is provoked to observe

Pediment too small.

Too many small parts.

this deviation without any good cause; the same objection is more palpably evident in the colonnade which encompasses the pedestal of the dome; here the columns are placed in pairs, and there is a break over each pair by which their connection with each other is totally interrupted. In the great order, the pediment, instead of being rendered a bold feature, by extending over the whole space where columns are introduced, and thereby affording room for sculpture, (the only purpose, in a square front, which renders a pediment admissible), is confined to four columns only, a thing unfit even in a private dwelling. Instead of preserving the face of the building plain and simple, to accord with its great outlines and gigantic order, the entrance doorways are of various dimensions and shapes, and the whole building is covered with small tablets, and perforated with small windows, even the dome itself, circumstances much to be regretted. With regard to the nature of the construction of the masonry of St Peter's, we are informed by Rondelet, an eminent French architect, that the outside of the walls is composed of a thin coating of cut travertine stone, that the middle is lined with bricks covered with stucco, and the space between filled with small irregular rubble stone mixed with mortar, that the counterforts are of cut stone, and that the ardour of Bramante hurried on the work with so much precipitation, without taking effectual measures to unite the different parts, and prevent unequal sinking, that by the time the four first arches had been completed, considerable fractures made their appearance;—that the architects who succeeded him, not being aware of the real cause of the fractures, nor considering that two of the pillars were placed upon the foundation of the circus of Nero, and the other two upon earth softened by the water from the adjacent sloping ground, thought only of increasing the points of support. San Gallo, an unprincipled builder, who was brought from Florence, enriched himself by performing the work very imperfectly; and even under Michael Angelo, the walls were filled with irregular stones, without care, arrangement, or ties. These are the true causes of all the fractures of the dome, &c. Indeed the architects, instead of studying the solidity and connection of the work as engineers, acted as painters, chiefly intent upon the appearance and decorations.

Private dwellings in Italy, from Palladio.
PLATE. CLXXVII.

From these public works we shall next proceed to the private dwellings of that æra, and, as the best authority, we shall select three specimens from Palladio, all of which will be found in Plate CLXXVII. Figs. 1. and 2. represent the plan and elevation of a town house, the lower rooms are in part sunk, and also rise 5 feet above the ground; over these are two principal stories, the lower of which is, in front, of the Doric, the upper of the Ionic order; in the lower of these a portico is extended along the whole front, and all the apartments have their ceilings vaulted; in the upper story the hall is in the middle of the front, and on each side there is a lofty vestibule. A great proportion of this edifice is occupied by halls, vestibules, stairs, and porticos; it is evidently fit only for a warm climate. The two orders being continued along the front without unnecessary breaks, and there being two regular rows of pretty lofty windows with flat tops, preserve an air of simplicity, but the upper row ought to have been higher, for there is too much dead wall over them.

Figs. 3. and 4.

House in the suburb of a city.

Figs. 3. and 4. represent the plan and elevation of a moderately sized house in the suburbs of Vicenza. It was built by Palladio in a fine situation for Signor Almerico; it has been much admired, and Mereworth castle in Kent was built upon the same model by Colin Campbell in 1723; the four vestibules have a fine effect, and the circular hall, with four entrances, is simple and elegant. In a square of 80 or 90 feet, four large, and an equal number of smaller apartments, may be obtained upon one floor; there is plenty of space for domestic offices below, and the same for bed-rooms above the principal story; the small triangular stairs without light, are objectionable; but as they are only for communicating with bed-rooms, the inconveniency is the less; those to the lower story may have borrowed lights.

Villa in th country.
PLATE CLXXVII. Figs. . an 6.

Figs. 5. and 6. represent the plan and elevation of a villa designed by Palladio upon the Brenta, for Sieur Moconico, a Venetian noblemen; it consists of a square encompassing a court, in which is a peristyle consisting of two heights of columns, the lower of the Ionic, the upper of the Corinthian order. From each external angle of the square is projected a circular portico, which connects with the offices. The principal entrance has a bold projecting portico of eight columns of the Composite order, 40 feet in height, and crowned with a pediment; behind the columns are pilasters 2 feet broad and 15 inches thick, which support an open gallery at the height of the principal story. In the middle of each external side there is a porch or loggia, formed each by four columns and two pilasters, standing in a line with the outer wall; these rise also to the height of the side walls, and are crowned with pediments. In the back front eight semi-columns are attached to the wall. On this side of the square there is a saloon or oecus 60 feet long and 30 feet broad, which is divided by two rows of eight columns each; over this, in the upper story, is a hall of the same dimensions, but without columns. The principal stair is in the peristyle of the inner court, on the side opposite to the great entrance. This edifice is in the style of the most magnificent Italian villas, and being the work of the ablest architect which that country has produced, must be admitted as a perfect specimen; the elegance of the elevation, however, appears injured by the smallness of the windows, and by the height being divided by a clumsy cornice; the roof also appears too heavy for the general airiness of character, and the elevations of the ends of the wings or offices are much too mean.

List of Ita lian architects and their works.

Although our limits will not permit us to adduce more specimens of the Italian architecture, we shall, in order to afford the reader a more comprehensive view of the rapid and extensive progress which the Roman architecture made in the course of two centuries, subjoin a list of the most celebrated Italian architects, with a statement of the principal works in which they were engaged.

Filipo Brunelleschi, born 1377, died 1444. His works and designs were as follow:

Church of Santa Maria del Fiore, at Florence.
Sagresty, and great part of the church of St Lorenzo.
The Capitolo de Pazzi in Santa Croce.
The Church Degli Angoli, an octagon, for the family Degli Scolari.
Model of the palace for Cosmo de Medici.
The palace Pitti, up to the second row of windows.
Model of the Casa de Busini.
Model of the house and loggie degli Innocenti.
The portico of the Hospital de Convalescenti.

Continuation of the Palazzo de Capitani.

A villa out of the gate of St Nicholas, for M. Luca Pitti,

Abbey of the Canons regular of Fiesole.

Leon Baptista Alberti, born 1398, died 1472 or 1480.

Repair of the conduit Aqua Virgine at Rome.

Design for covering the bridge of St Angelo.

New works and embellishments of the church of St Francis at Rimini.

Church of St Andrews at Mantua.

Portal of the church of Santa Maria Novella, at Florence.

Corinthian loggie and Doric front of the Palazzo Rucollai.

Chapel for the Rucollai family (reckoned fine.)

He wrote ten books, entitled *Re-ædificatoria.*

Bramante of Urbino, born 1444, died 1514.

Palazza della Cancellaria. Church of St Lorenzo in Damaso.

Palace built in 1504, by Cardinal Adriano da Corneto, and presented by him to the King of England.

Palace of the Dukes of Sora nella regione di Parione.

Palace of the Marchesi Corsini, begun from his design.

The great court, 400 paces long, between the old Vatican and the Belvidere.

The repository in the Belvidere, for the Laocoon, Apollo, Antinous, &c.

Little round temple in the cloister of St Pietro in Montorio.

Insulated temple without the walls of Todi, in form of a Greek cross, with a cupola, thought the model of St Peter's.

St Peter's Church.

Raphael Sanzio di Urbino, born 1483, died 1520.

Pallazza Ugoccioni, in the great ducal palace at Florence, since named Pandolfini.

The stables of Agostino Chigi alla Lungara, near the little Farnese, Rome.

Palazzo Caffarelli, near St Andrea della Valle.

House for himself in Borgo Nuovo (it was removed for the portico before St Peter's.)

Baldassare Peruzzi, born 1481, died 1536.

Palace alla Lungara, near Farnesina.

Models for the front of St Petronio, at Bologna.

Additions to the palace of Count Gio. Battista, Bentivoglio, at the same place.

The portal of the church of St Michele in Bosco, a little way from Bologna.

A dome, and the church of St Nicholas, at Carpi, in the state of Modena.

Variations of the plan of St Peter's at Rome, by order of Leo X.

The deposit of Adrian VI.

Two palaces for the family of Massini at Rome.

Designs for two villas of the S. S. Orsini, near Viterbo.

Palace of the Marquis of Silvestri, opposite St Lorenzo in Damaso.

Michele Sanmicheli, born 1484, died 1559.

Many military works, which we decline noticing in this place.

Model of the monastery of the nuns of St Biagio Catoldo at Venice.

Palace de Cornari a S. Paolo, and that of Grimani, upon the great canal.

Villa Soranzo, at Castel Franco, between Padua and Trevigi.

A deposit in the church of St Antonio at Padua.

Design for the front of Santa Maria in Organo.

The palaces Canessa, Beviacqua, Pellegrini, Pompei, Verzi, are all his.

The portals of the Pretorian and Prefectitial palaces at Verona.

Michael Angelo Buonarotti, born 1474, died 1564.

The Medicean Library at Florence.

The Sagrestry Nuova at St Lorenzo, in the same place.

St Peter's church at Rome, (he made a model of it in 15 days, which cost only 25 crowns.)

Designs for rebuilding the capital.

Pedestal for the equestrian statue of Marcus Aurelian.

The Cappella Strozzi at Florence.

The college of the Sapienza at Rome.

Giulio Romano, born 1492, died 1546.

Villa Madonna at Rome.

The church of Madonna del Orto.

Palazza Cicia Porci, in the Strada de Banchi; also that of the Cenci.

The palace T, a little way out of Mantua, (one of the finest edifices in Italy.)

He repaired and enlarged the Ducal palace, and built at Marmicuolo.

It was usual to say, that Mantua was a creation of Giulio Romano. He was appointed architect of St Peter's of the Vatican.

Sebastian Serlio was a distinguished artist in 1530, died 1552; he was a pupil of Baldassare Peruzzi. He was employed in France at the Louvre, Fontainbleau, Tournelles, &c. for Francis I.; and wrote seven books on geometry, perspective, and architecture.

Pirro Ligerio, died 1573.

The Pallazine in the wood of Belvidere.

The palace of Lancelotti in Piazza Navona.

He also acted as a civil engineer for the Duke of Ferrara.

Giacomo Barozzi, (Vignola), born 1507, died 1573.

Design for the front of St Petronio at Bologna.

Facciata di Banchi, a sort of wing to that cathedral.

Palace for Count Isolani, at Minerbio, near Bologna.

Plan for the ducal palace at Piacenza.

Churches of Mazzana, St Oreste, della Manno, degli Angeli, in Ossivi.

A beautiful chapel in the church of St Francesco in Perugia.

At Rome, the Acqua de Trevi, a villa without the Porta del Popolo, named Papa Guilio.

That part of the Farnese palace which contains the famous gallery painted by the Caracci.

On the Flaminian way, a chapel named St Andrea de Ponte Molli.

At Rome, he refitted the edifice now called the palace of Florence.

Portal of Lorenzo in Damaso.

Practice.

Church del Gesu (of which his part is good.)

The palace of Caprarola, about 30 miles from Rome, (his greatest work.) He also designed the Escurial in Spain.

He wrote a Treatise on the Five Orders, published at Venice, in 1570.

He conducted the Canale del Naviglio into Bologna.

Andrea Palladio, born 1508, died 1580.

The public palace at Udine, (at 22 years of age.)

Portico inclosing three sides of the Hall of Justice at Vicenza (about the same time.)

Front of the great church of St Petronio at Bologna.

Public palace of Brescia.

Olympic theatre at Vicenza, begun 158, (his greatest work.)

Church of S. Giorgio Maggiore, Refectory and Monastery.

Front of the monastery of S. Francesco della Vigna; del Redemptore, &c.

Repairs at the ducal palace at Venice.

At Vicenza, Santa Maria Nuova; Palazza Prefettezio; façade of the Palazzo Tornieri; that of the Pal. del Conti L. Schio.

And in his published works may be seen a description of nine town houses, and 24 country villas, many of them very commodious and magnificent. We have, in Plate CLXXVII. given plans of a town house, one in the suburbs, and one of a fine villa in the country, all from this excellent master. These specimens, by their extensive and airy colonnades and porticos, are evidently better calculated for an Italian than a British climate, but their general distribution is deserving of attention, and the whole are expressive of the manner of the age, country, and architect.

Plate CLXXVII.

Vincenzo Scamozzi, born 1552, died 1616.

At Venice, the deposit of the Doge Niccolo da unc Ponte, in the church Sa. Maria della Carita.
- Museum to the Library of St Mark.
- Continuation of the Procuratie Nuove in the Piazza of St Mark.
- The palace Cornaro, on the great canal, including the magnificent court.

Vicenza, the palace Trisino, now Trento.

Florence, the second story of the palace Strozzi.

Genoa, Palazza Ravaschieri, of three stories, Rustic, Ionic, Corinthian.

Sabonietta, in the Mantuan, a theatre after the ancient model.

Saltzburg, the cathedral.

Six of his books on architecture were published in 1615, viz. 1, 2, 3,—6, 7, 8.

From the foregoing statement, which includes only the works of the most celebrated Italian architects, it will be readily perceived with what ardour architecture had been pursued; and when to these are joined the ancient works still existing, it will be evident what a rich field of study Italy must prove for the zealous artist; since Rome, Florence, Venice, Vicenza, Mantua, Genoa, Verona, Padua, Bologna, Piacenza, Ferrara, with their adjacent country residences, all exhibit splendid specimens of architecture.

Practice of architecture in Britain.

We have less regret in leaving this justly celebrated peninsula, by having next to proceed with the practice of another country, still more important amongst modern nations—that is Britain.

Practice.

St Paul's London.

Plate CLXXIV.

Although later in point of time than some other specimens we shall adduce, yet, in order to preserve the progress of domestic architecture more entire, we shall first give a specimen of public buildings; and have, for this purpose, selected St Paul's cathedral, which was erected in London from a design and under the direction of Sir Christopher Wren. In Plate CLXXIV. the plan and elevation are drawn to the same scale as St Peter's at Rome. This comparison renders the disparity in size very conspicuous; but when it is considered, that the Italian temple was constructed at the joint expence of all the richest countries in Europe, and that the English temple was built at the expence of that nation alone, and immediately after the city had been destroyed by the great fire in 1666, its magnitude will appear not a little surprising. In taste and scientific skill, the architect was fully equal to any of his predecessors in this school; but the funds being limited, and materials of large dimensions not easily procured, he was prevented from adopting his favourite design, and obliged to substitute one in which the individual members were more minute.

St Paul's compared with St Peter's.

In the plan of the building, as executed, the dome is placed nearly in the middle of the length of the nave, or middle aisle; and as the terminations of the transept are square, the shape of the cross is not only *internally* different from that in St Peter's, but is *externally* more distinctly defined. In St Peter's, the length of the middle aisle, from the western entrance to the extremity of the choir, is only about eight times its width. In St Paul's it is above eleven times, which adds much to the imposing effect of the internal perspective. The breadth of the side aisles in St Paul's, bears a greater proportion to that of the middle one; and the form is more distinctly continued through the whole length of the edifice than in St Peter's. The piers which support the dome, are, in St Paul's, well disposed to afford stability, without too much crowding the space on the pavement. Immediately under the dome, a greater degree of simplicity would have been preserved, if the entire order had, as in the original design, reached sufficiently high to receive the whispering gallery upon the entablature, instead of resting, as it now does, upon large arches and their spandrels. Externally, the height of St Paul's is greater, in proportion to its breadth, than St Peter's, but not so much as materially to lessen the idea of stability, which is also well preserved by the square terminations of the projecting part of the transepts. This relative proportion creates a greater degree of apparent elevation, than if the edifice had more breadth. The dome is elegantly shaped; and the pedestal, or neck, upon which it immediately rests, being considerably raised, is the means of shewing the dome to advantage; while the order which supports this neck, having its columns distributed at equal distances, and well relieved, and having its entablature continued quite round, without any break, presents a feature which far surpasses that of any other structure of the kind. The dome has also its simplicity well preserved, by being clear of those pitiful small windows which disgrace St Peter's. A radical defect in St Paul's, is its having two orders in the height of the elevation, by which the simplicity and grandeur of the general effect are much diminished; but in the western façade, the upper and lower porticos, occupying a considerable proportion of the breadth, being also well isolated, and having a pediment enriched with sculptures extended over eight columns, produce, altogether, an imposing effect. The manner in which the turrets are constructed and finished, has little claim to commendation. The smallness and varied shape of the windows are objectionable. If there had been niches, with statues instead of windows, in the lower order, and the windows of the upper order made as large as the space would admit, and of uniform shape, the whole would have been more conformable to the character of a temple. We are aware, that this would have required a considerable change of the interior arrangement. The drawings we have given, will convey a distinct idea of the plan and elevation. For much of the interior we must refer to the building itself, and to the very masterly section made and published by Messrs Gwyn and Wale; but the following particulars, respecting the construction, cannot fail of being acceptible to the reader.

Taking down the old edifice.

"*Of the taking down the vast Ruins of the Old Cathedral, (St Paul's) and of the Foundations of the Old and New Structure.*—The pulling down the walls, being about 80 feet high, and five feet thick, was a great and troublesome work. The men stood above, and worked them down with pickaxes, whilst labourers below moved away the materials that fell, and dispersed them into heaps. The want of room made this way slow and dangerous, and some men lost their lives. The heaps grew steep and large, and yet this was to be done before the masons could begin to lay the foundations.

"The city having streets to pave anew, bought, from the rubbish, most of the stone called Kentish rag, which gave some room to dig and to lay foundations; which yet was not easy to perform with any exactness, but by this method:

"The surveyor placed scaffolds high enough to extend his lines over the heaps that lay in the way, and then by perpendiculars set out the places below, from the lines drawn with care upon the level plan of the scaffold.

"Thus he proceeded, gaining every day more room, till he came to the middle tower that bore the steeple. The remains of the tower being near 200 feet high, the labourers were afraid to work above, thereupon he concluded to facilitate this work by the use of gunpowder.

Used powder.

"He dug a hole of about four feet wide, down by the side of the north-west pillar of the tower, the four pillars of which were each about fourteen feet diameter. When he had dug to the foundation, he then, with crows and tools made on purpose, wrought a hole two feet square, level into the centre of the pillar. There he placed a little deal box, containing eighteen pounds of powder, and no more. A cane was fixed to the box, with a quick-match (as gunners call it) within the cane, which reached from the box to the ground above; and along the ground was laid a train of powder, with a match. After the mine was carefully closed up again, with stone and mortar, to the top of the ground, he then observed the effect of the blow.

"This little quantity of powder not only lifted up the whole angle of the tower, with two great arches that rested upon it, but also two adjoining arches of the aisles, and all above them; and this it seemed to do somewhat leisurely, cracking the walls to the top; lifting visibly the whole weight about nine inches, which suddenly jumping down, made a great heap of ruin in the place without scattering. It was half a minute before the heap, already fallen, opened in two or three places, and emitted some smoke. By this description may be observed the incredible force of powder: 18 pounds only of which lifted up above 3000 tons, and saved the work of 1000 labourers.

"The fall of so great a weight, from a height of 200 feet, gave a concussion to the ground, that the inhabitants round about took for an earthquake.

"Encouraged by this success, he thought to proceed this way; but being obliged to go out of town in the king's service, he left the management of another mine begun to the care of his next officer, who, too wise in his own conceit, put in a greater quantity of powder, and neither went low enough, nor sufficiently fortified the mouth of the mine; and though it had the effect, yet one stone was shot out to the opposite side of the church-yard, through an open window, into a room of a private house, where some women were sitting at work, without any harm done. This accident frightened the neighbours to that degree, that he was importuned to use no more powder, and was so directed also by his superiors; though, with due caution, it might have been executed without any hazard, and saved much time and money.

"He then turned his thoughts to another method, to gain time, prevent much expence, and the endangering of men's lives; and that was, to make an experiment of that ancient engine in war, the battering ram.

A strong mast as a battering ram.

"He took a strong mast, of about 40 feet long, arming the bigger end with a great spike of iron, fortified with bars along the mast, and ferrels. This mast, in two places, was hung up to one ring with strong tackle, and so suspended level to a triangle prop, such as they weigh great guns with. Thirty men, fifteen on a side, vibrated this machine to and again, and beat in one place against the wall the whole day. They believed it was to little purpose, not discerning any immediate effect. He bid them not despair, but proceed another day. On the second day, the wall was perceived to tremble at the top, and in a few hours it fell. The reason to be given for it may be this: It is not by any present violence the ram is able to overturn a wall of such bulk and compacture, but incessantly vibrating by equidistant pulses, it makes a small intestine motion through all the insensible parts of the wall, and by degrees loosens all the bond of the mortar, and moves every stone from its bed; and though not the hundredth part of an inch every blow, yet this motion, once begun, hath its effects more and more, till at length it is quite loose, and falls. He made good use of this machine in beating down all the lofty ruins, and pleased himself that he had recovered this notable engine, of so great service to the ancients in besieging of towns, though great guns have now put them out of use, as more expeditious, and requiring fewer men to manage.

Description of ground and foundations.

"It has been before observed, that the graves of several ages and fashions, in strata, or layers of earth, one above another, particularly at the north side of St Paul's, manifestly shewed a great antiquity from the British and Roman times, by the means whereof the ground had been raised. But, upon searching for the natural ground below these graves, the surveyor observed, that the foundation of the old church stood upon a layer of very close and hard pot earth; and concluded, that the same ground which had borne so weighty a building, might reasonably be trusted again. However, he had the curiosity to search farther, and accordingly dug wells in several places, and discerned this hard pot earth to be on the north side of the church-yard about six feet thick, and more, but thinner and thinner towards the south, till it was, upon the declining of the hill, scarce four feet. Still he searched lower, and found nothing but dry sand, mixed sometimes unequally, but loose, so that it would run through the fingers. He went on till he came to water and sand mixed with periwinkles and other sea shells: these were about the level of low water-mark. He continued boring till he came to hard beach; and still under that, till he came to the natural hard clay, which lies under the city and country, and Thames also, far and wide." Wren's *Parentalia*, p. 283, 284, 285.

"The sand hill at Paul's, in the time of the Roman colony, was about twelve feet lower than it now is; and the finer sand easier driving with the wind, lay uppermost, and the hard coat of pot earth might be thus made; for pot earth dissolved in water, and viewed by a microscope, is but impalpable fine sand, which with the fire will vitrify; and, of this earth upon the place, where those urns, sacrificing vessels, and other pottery ware, made, which, as before noted, were found here in great abundance, more especially towards the north east of the ground.

Bad ground met with in the north-east corner.

Pottery ware found.

A pit sunk to the level of the Thames.

A square pier built.

"In the progress of the works of the foundations, the surveyor met with one unexpected difficulty; he began to lay the foundations from the west end, and had proceeded successfully through the dome to the east end, where the brick earth bottom was yet very good; but as he went on to the north east corner, which was the last, and where nothing was expected to interrupt, he fell, in prosecuting the design, upon a pit, where all the pot earth had been robbed by the potters of old time. Here were discovered quantities of urns, broken vessels, and pottery ware of divers sorts and shapes; how far this pit extended northward, there was no occasion to examine; no ox-skulls, horns of stags, and tusks of boars were found, to corroborate the accounts of Stow, Camden, and others, nor any foundations more eastward. If there was formerly any temple to Diana, he supposed it might have been within the walls of the colony, and more to the south. It was no little perplexity to fall into this pit at last. He wanted but six or seven feet to complete the design, and this fell in the very angle north east. He knew very well, that under the layer of pot earth, there was no other good ground to be found till he came to the low water mark of the Thames, at least forty feet lower. His artificers proposed to him to pile, which he refused, for though piles may last forever, when always in water, (otherwise London bridge would fall,) yet if they are driven through dry sand, though sometimes moist, they will rot. His endeavours were to build for eternity. He therefore sunk a pit of about eighteen feet square, wharfing up the sand with timber, till he came forty feet lower into water and sea shells, where there was a firm sea beach, which confirmed what was before asserted, that the sea had been in ages past, where now Paul's is; he bored through this beach till he came to the original clay; being then satisfied, he began from the beach, a square pier of solid good masonry, ten feet square, till he came within fifteen feet of the present ground, then he turned a short arch underground to the former foundation, which was broken off by the untoward accident of the pit. Thus this north east coin of the quire stands very firm, and, no doubt, will stand. This narrative may be of use to others not to trust piles, unless always, and in all parts, wet; for almost all sorts of timber under water will prove everlasting, but wet and dry will soon perish. The same cannot be said of iron, for that will decay under water: but this has been observed, in taking out cramps from stone work, at least 400 years old, which were so bedded in mortar, that all air was perfectly excluded. The iron appeared as fresh as from the forge. Therefore in cramping of stones, no iron should lie within nine inches of air, if possible; for the air is the menstruum that consumes all materials whatever. When there is a necessity to use iron for want of stones large enough, care is to be taken to exclude sufficiently the air from it. To mention another caution of use to artificers; some cornices of large projections, though the upper joints are as close fitted as good workmen can make them, yet in the melting of snow, the water will dribble through, and stain the cornice. The surveyor thus avoided this inconvenience; he caused the masons so to work the stone next the joint, as to leave half a quarter of an inch, rising on each side, that the water might sooner fall off, than soak to the joint; and this he observed in the paving of the upper portico of the principal front of St Paul's; besides, that the joints are run with lead: and the same is done, wherever he was obliged to cover with stone only." Pp. 285, 286.

Begun 1675, completed 1710.

"The first stone of this Basilica was laid in the year 1675, and the works carried on with such care and industry, that by the year 1685 the walls of the quire and side aisles were finished, with the circular north and south porticos; and the great pillars of the dome brought to the same height; and it pleased God in his mercy to bless the surveyor with health and length of days, and to enable him to complete the whole structure in the year 1710, to the glory of his most holy name, and promotion of his divine worship, the principal ornament of the imperial seat of this realm.

"The highest or last stone on the top of the lantern, was laid by the hands of the surveyor's son, Sir Christopher Wren, deputed by his father, in the presence of that excellent artificer Mr Strong, his son, and other free and accepted masons, chiefly employed in the execution of the work.

"Thus was this mighty fabric, the second church for grandeur in Europe, in the space of 35 years, begun and finished by one architect, and under one Bishop of London, Dr Henry Compton."

Description of St Paul's.

Dome.

The piers of the vestibule stand upon an octagonal plan. They have archivolts thrown over them, resting upon every two adjacent piers, and forming eight arcades. The spandrels are filled with spheric portions to the level of the summits of the archivolts, and there form a complete circle. Upon this an entablature is laid, and the projections, being protected at the outer edge by an iron railing, constitutes what is termed the *whispering gallery*. Above this, the cylindric wall is raised to the base, or springing of the dome. The dome is formed of eighteen inch brick-work, and has a course of long bricks inserted through its whole thickness at every five feet in height. It was turned upon a centre, laid without standards or supports from below, every story of this scaffolding being circular, and the ends of all the ledgers meeting as so many rings, and truly wrought, it supported itself. The exterior dome is constructed of oak timber, supported by timbers, which rest upon a brick cone, two bricks in thickness. This cone springs from the same base with the exterior dome, and supports the stone lantern or cupola, which is equal to 700 tons. This dome rises higher than a semicircle; and the sides of its section, which are struck from centres in the base line, would, if continued, meet in an angle in its axis. See CARPENTRY, Plate CXXIX. Fig. 8.

In order to render the dome, cone, and cupola or lantern secure, immediately under where the cone comes in contact with the extrados of the interior dome, a channel is cut in a curbing of Portland stone, in which is laid a double chain of iron, strongly linked together at every ten feet, and the whole channel filled with lead. There is a similar hooping behind the frieze of the pedestal, which supports the exterior dome; and also four others, at different heights, surround the cone which supports the cupola or lantern.

Dimensions.

The extreme length of this edifice is 530 feet; its breadth, exclusive of the two circular porches, 250 feet; and its height, from the pavement to the top of the cross, is 366 feet. Height of the central nave to the crown of the arch 85 feet. Height to the top of interior dome 218 feet. Diameter of ditto, at whispering gallery, 112 feet. Diameter of exterior dome 140 feet. The total expence is stated at £736,752; of which £126,000 was raised by contribution, £1000 a year was paid by the king, and the remainder was raised by a tax upon coals brought into the port of London.

Old St Paul's.

Old St Paul's Church was first built in the year 610. It was burnt down in 964, and rebuilt in 1240. The steeple was struck with lightning in 1443, and rebuilt in 1631. The whole was totally destroyed by the great fire in 1666.

St Stephen's, Walbrook.

Plate CLXXV. Fig. 1.

Of the other numerous churches erected during the restoration of the city of London, after the before mentioned great fire, under the direction of Sir C. Wren, we shall only select that of St Stephen's Walbrook, which stands near the Mansion-house. We have fixed upon this, on account of the variety of forms it exhibits, and the ingenuity and taste displayed in the arrangement and decorations. The ground-plan, as will be seen, (Plate CLXXV. Fig 1.) is a parallelogram, 75 feet in length, and 56 in breadth, which affords room for two rows of seats, with a passage along each wall and in the middle; and this is the space judged convenient for an English church, to enable an audience to hear the service, if distinctly performed. The columns are placed along the outer passages, so as also to form a parallelogram; but within these, at each end, two others are introduced, by which a column is placed upon each angle of an octagon. The entablature, supported by the columns, is upon a rectangular plan; but upon it, the archivolts, rising upon every two of the before mentioned inner columns, complete an octagon, as in Fig 2.; and between these archivolts, spheric spandrels, being carried up to the level of the top of them, form a circle, as in Fig 3. Over the top of the archivolts, a piece of plain wall is carried up, equal in breadth to the margins, which surround the pannels in the spheric spandrels. Upon the cornice, which is laid upon the top of this, rises a dome 44 feet diameter, and 22 feet high, upon the apex of which stands a small cupola. The dome is decorated with enriched sunk pannels. The ceiling, supported by the columns, is flat adjacent to each angle of the great parallelogram; but the roof is supported by groin arches, with archivolts springing from the top of the entablature, and both the soffits and faces of the archivolts are enriched. By the columns being raised upon pedestals, and being of the Corinthian order, they appear rather too diminutive for the support of the dome. If the whole light had been procured from the upper part, and if the face of the walls had been divided by pilasters, and the spaces between them filled with niches, paintings, and sculptured tombs, this beautiful and ingenious piece of architecture would have been rendered still more perfect.

Plate CLXXV. Fig. 2.

Fig. 3.

Dimensions of 51 *Parochial Churches of the City of London, erected according to the Designs, and under the care and conduct of Sir Christopher Wren, in room of those which were burnt and demolished by the great Fire in the Year* 1666; *together with other Churches built and repaired, and Public Buildings.*

No.	Name.	Situation.	Length.	Breadth.	Height.	Height of steeple.	Time when built.	Order.
1	Allhallows	Bread-street	72	35	30	86	1684 steeple 1697	Tuscan, steeple Doric.
2	Allhallows the Great	S. side Thames-street	87	60	33	86	1683	Tuscan.
3	Allhallows	Lombard-st. N. side	84	52	30	85	1694	Ditto.
4	St Alban, Wood-st.	E. side Great Wood-street.	66	59	33	85½ or to top of pinnacles 92	1685	Gothic.
5	St Anne and Agnes	N. side St Anne's-lane	53	53	35	84	1680	Corinthian.
6	St Andrew's Wardrobe	E. side Puddledock-hill	75	59	38	86	1692	Tuscan.
7	St Andrew's, Holborn	South side Holborn-hill	105	63	43	110	1687	Corinthian.
8	St Anthony's . . .	W. end Watling-st.	66	54	44	154	1682	Tuscan, within Composite
9	St Augustin's . . .	N. side Watling-st.	51	45	40	145	1683 steeple 1695	Ionic.
10	St Benedict	E. side Gracechurch-sreet	60	30	32	149	1685	
11	St Bennet's, Paulf-wh.	N. side Thames-st.	54	50	36	118	1683	Corinthian.
12	St Benedict	N. side Threadneedle-street	63	48	49	110	1673	Composite.
13	St Bartholomew's .	E. side Bartholomew-lane	78	60	41	90	1679	Tuscan, doors Corinthian
14	St Bridge's, *or Bride's*	S. side Fleet-street	111	57	41	234	1680	Do. tower Corinthian.
15	Christ Church . . .	N. side Newgate st.	114	81	38	153	1687 spire, &c. 1704	Composite.
16	St Christopher's .	N. side Threadneedle-street	60	52	40	80	1671 part rebuilt.	Old, Gothic; new, Tusc.
17	St Clement's Danes	W. of Temple-bar	96	63	48	116	1682	Corinth. S. portico Ionic.
18	St Clement's East-cheap	E. side St Clement's-lane	64	40	34	88	1686	Composite.
19	St Dionis, back . .	W. side Lime-street	66	59	34	90	1686	Ditto.

No.	Name.	Situation.	Length.	Breadth.	Height.	Height of steeple.	Time when built.	Order.
20	St Dunstan's, East	Between Tower-st. N. & Thames-st. S.				75	repaired, & steeple built, in 1698	Windows and steeple Gothic, pillars within Tuscan.
21	St Edmund the King	N. side Lombard-st.	69	39	33	90	1690	Tuscan.
22	St George	W. side Botolph-lane	54	36	36	84	1674	Composite.
23	St James	E. side Garlic-hill .	75	45	40	90	1683	Corinth. outside, Ionic within.
24	St James, Westminster	N. side Jermyn-st. .	84	63	42	149		Pillars outside Corinthian, doors do. Ionic, upper windows at E. end Composite, lower do. Corinthian
25	St Lawrence, Jewry	N. side Cateaton-st.	81	68	40	130	1677	Corinthian.
26	St Magnus	N. end Lond.-bridge	90	59	41		1676	Ionic.
27	St Margaret's, Lothbury	N. side Lothbury . .	66	54	36	140	steeple 1705 1690	Corinthian.
28	St Margaret's, Pattens	N. side Little Tower-street	66	52	32	198 2	1687	Tower and spire Doric, outer door W. end Tuscan, pillars within Corinthian.
29	St Martin's, Ludgate	N. side Ludgate-st.	57	66	59	168	1684	Tower and spire Tuscan, columns that support the roof Composite.
30	St Mary, Abchurch	W. side Abchurch-lane	63	60	51	140	1636	
31	St Mary-at-hill . .	W. side St Mary-at-hill	96	60	roof 26, to centre of cupola 38	96	1672	No order at all.
32	St Mary, Aldermary	E. side Bow-lane .				135	1711 upper part of tower rebuilt.	
33	St Mary Magdalen	N. side Little Knight-rider-street . . .	60	48	30		1685	
34	St Mary Somerset	N. Side Thames st.	83	36	30	120	1695	
35	St Mary-le-bow . .	S. side Cheapside .	65½	63	38	225	1673 steeple 1680	Corinthian columns to roof; door to tower Tuscan piers and arch, and Doric columns and entablatures above Ionic windows; columns at bottom of spire Corinthian; a little higher, pedestals, columns, and entablature, of Composite.
36	St Mary, Woolnoth	S. side Lombard-st.					1677 repaired.	
37	St Mary, Aldermanbury	Aldermanbury.	72	45	38	90	1677	Composite.
38	St Matthew, Friday-street	W. side Friday-st.	60	33	31	74	1685	
39	St Michael, Basinghall	W. side Basinghall-street	70	50	42	75	1679	Corinthian.
40	St Michael Royal .	E. side College-hill	86	48	40	90	1694	
41	St Michael, Queenhythe	S. W. angle Little Trinity-lane . .	71	40	39	135	1677	

No.	Name.	Situation.	Length.	Breadth.	Height.	Height of steeple.	Time when built.	Order.
42	St Michael, Wood-st.	W. side Great Wood-street	63	42	31	90	1675	Ionic.
43	St Michael, Crooked-lane	E. side St Michael's-lane	78	46	32	100	1688	
44	St Michael, Cornhill	S. side Cornhill . .	87	60	35	130	1672	Tuscan.
45	St Mildred, Bread-street	E. side Bread-street	62	36	40	top of dome 52, and top of spire 140	1683	
46	St Mildred, Poultry	N. side Poultry . .	56	42	36	75	1676	
47	St Nicholas, Cole-abbey	S. side Fish-street .	63	43	36	135	1677	Corinthian.
48	St Olave's, Jewry .	W. side Old Jewry	78	34	36	88	1673	
49	St Peter's, Cornhill	Cornhill	80	47	40	140	1681	Corinthian.
50	St Sepulchre's . . .	N. side Snow-hill .	126	58	35	140	1670	Gothic, spires on tower; do. windows; columns inside, Tuscan.
51	St Stephen's, Coleman-street	Coleman-street . .	75	35	44	65	1676	
52	St Stephen's, Walbrook	Near Stock's market	75	56	34 cupola & lantern 58	70	1676	Corinthian.
53	St Swithen's	N. side Cannon-st.	61	42	40	150	1679	Composite.
54	St Vedash	E. side Foster-lane	69	51	36	90	1697	Tuscan.

"In the 9th year of the reign of Queen Anne, 1708, an act of Parliament passed to erect 50 new additional parish churches in the cities of London and Westminster. The surveyor, being appointed one of the commissioners for carrying on the works, attended that service with all the application his other offices would permit; and preparatory thereunto, took occasion to impart his thoughts to this effect, in a letter to a friend in that commission." *Parentalia*, pp. 309—318.

General observations.

"The capacity and dimensions of the new churches may be determined by a calculation. It is, as I take it, pretty certain, that the number of inhabitants, for whom the churches are provided, are 5 times as many as those in the city who were burnt out, and probably more than 400,000 grown persons that should come to church, for whom these 50 churches are to be provided, (besides some chapels already built, though too small to be made parochial.) Now, if the churches could hold each 2000, it would yet be very short of the necessary supply. The churches therefore must be large; but still, in our reformed religion, it should seem vain to make a parish church larger, than that all who are present can both hear and see. The Romanists, indeed, may build larger churches; it is enough if they hear the murmur of the mass, and see the elevation of the host; but ours are to be fitted for auditories. I can hardly think it practicable to make a single room so capacious, with pews and galleries, as to hold above 2000 persons, and all to hear the service, and both to hear distinctly and see the preacher. I endeavoured to effect this in building the parish church of St James's, Westminster, which, I presume, is the most capacious with these qualifications that hath yet been built; and yet at a solemn time, when the church was much crowded, I could not discern from a gallery that 2000 were present. In this church I mention, though very broad, and the middle nave arched up, yet as there are no walls of a second order, nor lanterns, nor buttresses, but the whole roof rests upon the pillars, as do also the galleries, I think it may be found beautiful and convenient, and, as such, the cheapest of any form I could invent.

"Concerning the placing of the pulpit, I shall observe,—a moderate voice may be heard 50 feet distant before the preacher, 30 feet on each side, and 20 behind the pulpit, and not this unless the pronunciation be distinct and equal, without losing the voice at the last word of the sentence, which is commonly emphatical, and, if obscured, spoils the whole sense. A Frenchman is heard further than an English preacher, because he raises his voice, and not sinks his last words. I mention this as an insufferable fault in the pronunciation of some of our otherwise excellent preachers, which schoolmasters might correct in the young as a vicious pronunciation, and not as the Roman orators spoke; for the principal verb is in Latin usually the last word, and, if that be lost, what becomes of the sentence?

"By what I have said, it may be thought reasonable, that the new church be at least 60 feet broad, and 90 feet long, besides a chancel at one end, and the belfry and portico at the other. These proportions may be varied; but to build more room than that every person may conveniently hear and see, is to create noise and confusion. A church should not be filled with pews, but that the poor may have room to sit and stand in the alleys, for to them equally is the gospel preached. It were to be wished there were to be no pews but benches; but there is no stemming the tide of profit, and the advantage of pew-keepers." Pp. 320, 321.

Having given an account of sundry churches in the metropolis, we shall now describe one lately erected in a small provincial town, and another in a country village, from both designs made by Mr Telford. The former

Bridgenorth church.

stands within the precincts of the old castle of Bridgenorth in Shropshire. It was completed in 1796. The extreme length over the walls is 121 feet, the breadth 67; the height of the side walls, including the plinth upon which the order stands, and exclusive of the parapet, is 36 feet 6 inches. The height of the tower is 114 feet. The plan and elevation will be seen in Plate CLXXVI. From these it will appear, that externally a Tuscan order is continued round the fabric, and that, excepting two columns at the entrance, it is composed of pilasters. There is a pediment at each end, and a parapet in every other place. In the body of the church there are no breaks; those near the extremities are made to distinguish the several parts of the edifice; also by dividing the length, the elevation acquires some appearance of loftiness, and some resemblance of the ancient porticos is thereby obtained. The Tuscan order, besides being the most economical, has, when constructed of this magnitude, an air of majestic gravity; it is also in due subordination to the decorations of the outside of the superior part of the tower, and the interior of the church. There is only one row of windows 21 feet 3 inches high. In the tower, the belfry story has the Doric order in strong relief, and its entablature is carried along each face without any break. Over this is the apartment for the clock, and the whole is covered with a dome.

Plate CLXXVI. Description of outside.

Interior.

Internally, the body of the church is a parallelogram 77 × 60 feet; the middle aisle is 29 feet 9 inches in height from the pavement to the ceiling. The side aisles 27 feet. Six Ionic columns are placed along each side of the middle aisle, and two of larger dimensions stand at the entrance into the chancel, so that the full Ionic entablature is continued quite round the middle aisle. The chancel is square, and, to render it more solemn, is lighted from the top. This also makes room for paintings or statuary over the altar, and on each side of it. On one side of the chancel is a vestry room for the clergyman, on the other side is one for the parish officers. The church is sufficiently lighted by the three large windows on each side. Originally, there was only a narrow gallery at the entrance end for the singers; but some years after the church was completed, in order to obtain more pews, a gallery was erected along each side. On each side of the circular entrance lobby, are stairs which communicate with the galleries. The space contained in the body of the church corresponds to that recommended by Sir C. Wren, as the maximum for an audience hearing distinctly, viz. 50 feet in front, 30 on each side, and 20 behind the speaker.

Plate CLXXVI. Churches in the villages of Madely and Dawley.

Plate CLXXVI. is the plan of a church for the village of Madely, near Coalbrookdale, in the county of Salop. It was with some slight changes erected there, and a similar one at the adjacent parish of Dawley. Galleries being here considered absolutely necessary, the design was made with the view of forming and lighting the body of the church independent of them. For this puspose it was made 70 feet by 50, from which a space at each end of the four angles is cut off, to admit of large windows. From each of the longest sides there is a recess of 38 feet by 12, to contain galleries, &c. At the entrance end is a projection, to receive the bell tower, and, at the opposite end, is one for the chancel and two vestries. Externally, this arrangement affords great regularity of front in each direction. The dimensions being marked in the plan, every part will be evident by inspection. This church contains 1000 commodious sittings, besides what may be placed in the passages. The pulpit may be placed nearly in the middle of the chord line of a semicircle, which shall extend to the opposite sides, and being perhaps the most suitable of all positions.

Private dwellings.

Having seen the progress that the revived Roman architecture made in sacred edifices, we shall next endeavour to trace it in the private dwellings of different periods.

From a very well written account of the town of Shrewsbury, we have the following particulars respecting old English habitations.

Town houses.

The town houses of our forefathers, as far as they relate to the present subject, may be divided into the kernelled or embattled mansion, the hall or unembattled gentleman's house, and the tradesman's habitation. The embattled mansion partook both of the castellated and collegiate forms. Like the former, it was crowned with embrasures, and surrounded always in the country, and sometimes even in towns, with a moat, but had seldom more than one tower placed at the point of most strength, which consisted of three or four stories, containing on each floor a single room. These were doubtless built on the principles of the keeps of castles. Like colleges, the embattled houses were uniformly constructed round a quadrangle, with a turretted gate-house of entrance, though not fortified with the massive round towers and portcullis of the castle gate. The principal apartments were the hall, the great chamber, kitchen, and chapel. The hall was a copy of those in colleges, which in their turn were of conventual origin. Here the master, with his family and superior guests, dined every day at a long oak table, elevated on two or three steps called the high-dees at the upper end, whilst the tenants, and those of inferior rank, were seated at a table below, at right angles with the former. The hall was lighted with one or more Gothic windows, and a long bow window, forming a recess near the high table. It had no fire-place, but was warmed by a brazier of live coals in the middle, the smoke escaping from a hole in the top. This apartment being anciently always open to the roof, the timbers were formed into a pointed arch, carved and adorned with arms, rebusses, and quaterfoils. At the tower end was a wooden screen of latticed work, which supported a gallery for the minstrelsy on great days. Under it ran a narrow lobby with a passage through, which communicated with the buttery hatch, where the butler attended, to administer ale to the numerous applicants at all times of the day, and beyond these were the offices. The great chamber adjoined the hall at the upper end. In this apartment was the luxury of a fire place, if the wide open chimney-pieces of our ancestors deserve to be called luxuries, and it was the usual resort of the family when not at their meals. It is conceived also, that, as in the combination-room of colleges, and the locutorium, or parlour of monasteries, the master with his chief guests often retired soon after dinner from the cold atmosphere of the hall, to the social comfort of its hearth, while the inferior visitors were left to carouse by the dying embers of the brazier they had left.

The chapel was a small room often over the gateway, and sometimes adjoining it, and was rather an oratory for private devotion than for the assembling of a congregation.

Embattled mansion in the country.

To these ancient fortified houses succeeded the embattled mansion of Queen Elizabeth, or James I. This was of two kinds, the greater and the less; one an improvement upon the rude quadrangle, the other an expansion of the ancient castlet; one luminous and magnificent, with deep projecting bow windows, and the other lofty, square, and compact. Of the great square windows in such houses, it is a well known complaint of Lord Bacon, "that one knows not where to become to be out of the sun." The characteristic accompaniments of these houses within, were huge arched fire-places in their halls and kitchens; chimney-pieces in their chambers of state, richly carved, and adorned with armorial bearings, mixed with grotesque figures in wood, stone, or alabaster; raised hearths, long and massy tables of oak, from their bulk calculated to last for centuries. One apartment seldom omitted in houses of this rank and date, but never found in those of higher antiquity, was a long gallery for music and dancing, sometimes 150 feet long; a proof that the hall was now beginning to be deserted. At all events, the practice of dining in these great apartments at different tables, according to the rank of the guests, was scarcely continued below the Restoration.

Embattled mansion in towns.

The unembattled gentleman's house in towns partook of the general features of the above, but were of smaller dimensions, and without any fortifications. These were in general retired from the street by a small court, two or three sides of which were enclosed by the house and offices, the rest with walls, and shut up with a gate, usually without any lodge or apartment over it. The most ancient of such houses consisted of a thorough lobby, with a parlour beyond it on one side with a stone floor, the kitchen and offices on the other. The partitions were of rude oak, the chimnies wide and open, and the rooms, except the hall and great parlour, low and small. These comfortless habitations were succeeded by the houses of Queen Elizabeth's days. In them the original form was retained, though with considerable improvements. The entrance was by an enclosed projecting porch, which led to the hall. This was lighted generally by one great square window with cross mullions, a massy oak table beneath, at the lower end a gallery for music, or to connect the apartments above, and a fireplace, embracing in its ample space almost all the width of the room, the Christmas scene of rude and boisterous festivity; beyond was uniformly a parlour, and, on the other side, the great chamber, or withdrawing room, sometimes up three or four steps. In the windows of such houses, and those of a rank above them, are found the remains of painted glass, in a style which seems to have been fashionable in the seventeenth century; they consist of arms, cyphers, figures of animals, and scripture histories, or others in small round and oval pieces. Of these the drawing is extremely correct, but the colours faint and dingy, very unlike the deep and glowing tints of the foregoing centuries. These were probably of Flemish manufacture.

The tradesman's house.

The tradesman's house was one, or sometimes two long ranges united, terminating with gables in the street. The shop occupied the whole breadth next the street, and was entirely without glass, like our present unsightly butchers shops. Behind was a kitchen, and beyond a small open yard, round which were the warehouses and offices. The pride of the owners were their signs, which denoted the trade or craft by some animal or device. These either projected far into the street from the house, or were stuck upon high timbers opposite the door. In former days, our towns must have exhibited the appearance of the streets of Pekin, rather than of the open and lively air of a modern European city. The barber's solitary pole, and here and there a heavy gilt sign, projecting from an inn in an old town, are the only remains of these clumsy and inconvenient ornaments.

Longleate.

Amongst the earliest houses on the Italian model in England, was the princely mansion of Longleate, in Wiltshire, the seat of the marquis of Weymouth; it was built from the designs of Hans Holbein, in the reign of Edward VI. The plan and elevation may be seen in Plate CLXXVIII. It surrounds three sides of a parallelogram, measuring externally 220 feet from east to west, and 175 feet from north to south. The height is divided into three stories, the lowest has Doric pilasters, &c. the middle Ionic, and the upper Corinthian. In the south or principal front, in the lower story, there are sixteen windows and a door; in each of the other stories of this front are seventeen windows; the size of the lower ones is 9 feet × 4 feet 6 inches; of the middle 10 feet × 4 feet 6 inches; and the upper 7 feet × 4 feet 6 inches. They are each surrounded by a plain slender architrave, and some have tablets and small trusses under the belt which forms their sills, and this belt also forms the cap of the pedestal of the order. There is a parapet and balusters along the top of the front; there are also three small cupolas. The entrance door-way has a Doric column and pilaster on each side of it; over these is an open pediment with arms in the open parts. In this south front, near each extremity, there are two square projections, each occupying 21 feet in length, and separated by about an equal distance; on the east and west sides, are three similar projections, and one at each extremity of the northern side.

Plate CLXXVIII.

Description and dimension.

In the principal story, there is a hall 51 × 30 exclusive of the recess; an apartment on the right hand 42 × 30, exclusive of two recesses; one on the left 37 × 30, exclusive of one recess; the recesses are 17 × 8. Besides these, there is one apartment 30 × 25; one 27 × 23; a bedroom 24 × 23, ditto 31 × 22, ditto 23 × 22; a waiting room, at the entrance, 22 square; a chapel 47 × 22; and a staircase 27 × 21, besides others of inferior note.

Remarks.

From this specimen, it appears, that the school was imported in a very improved state; its external appearance having a perfect regularity, and being nearly free of tawdry ornaments, is evidence of correct taste, and great care in forming the design. By having a separate order for each story, the members are rendered very minute, but in a private dwelling, where several rows of windows are unavoidable, those slender proportions are more appropriate than in a public edifice. The upper windows are preserved of a good size. In the interior arrangement, the hall, and some of the principal rooms, have their uniformity destroyed by the recesses, and several of them are injured by thorough fares. What has here been described, applies to the house in its original state; but the whole interior has lately been renovated and improved, with much judgment and success, by Mr Jefferey Wyatt, and is now rendered a very superb habitation.

Inigo Jones.

Heriot's Hospital.

The next in succession, is the celebrated Inigo Jones, who about a century afterwards practised architecture extensively both in England and Scotland. In his magnificent edifice, **Heriot's Hospital**, (begun in 1628,) may be observed many features corresponding with some to be found in Longleate, only he has here been more profuse in sculptured ornaments about doors and windows, and has adhered more to the style of the baronial castle. Having formerly described this edifice pretty fully, we shall only here recommend attention to the mode of managing the chimney tops, which he has made of a polygonal shape, with concave sides. We have in another place already mentioned, that the operation of changing styles from Gothic to Roman, is very perceptible in some parts of this edifice.

Castle Ashby.

Castle Ashby, in Northamptonshire, was a work of the same architect, begun in 1642. It forms three sides of a square, whereof two sides consist each of three stories in height, while the one which unites them is only two stories. The two higher sides, like Longleate, are composed of the Doric, Ionic, and Corinthian orders. The two upper rows of windows are nearly of an equal size, the lower ones are smaller. This singular feature has a good effect. With regard to the interior, the apartments are too narrow for their lengths, thereby much resembling galleries: their being thorough fares is also very objectionable.

Wilton House.

WILTON, the seat of the Earl of Pembroke, was begun by Inigo Jones, in 1640. The garden front extends 194 feet. It consists of one row of large windows, with square attics over them, and small ones in the basement below: these latter have segment tops, and clumsy arch stones. All the other windows have architraves and flat entablature, except those in the turrets, which are at the extremities, which have pointed pediments over the principal windows. The turrets rise higher than the rest of the building, and have each a circular pediment over a window in this part. Between the turrets, an entablature with modillions passes unbroken. This, with the plain ground, or face of the building, has a good effect. Upon this entablature there is a parapet, with balusters, which hides the roof. The entrance door has coupled Ionic pilasters, with an arch like that over the middle of a Venetian window. On each side of this is a figure in a reclined posture, holding a small medallion of the family arms betwixt them. The plan, consisting of single apartments encompassing a court 105 × 95, renders the access inconvenient.

Description.

Dimensions.

The great dining room is 60 × 30 × 30; the ceiling is coved, the coved part plain, but the flat part is thrown into compartments twelve inches in depth, encompassed with enriched mouldings. A modillion cornice, with an enriched frieze, passes round the room; the architrave has only one member enriched; the whole depth of the entablature is three feet four inches, or $\frac{1}{6}$ of the upright part of the room. The pannelled dado occupies another $\frac{1}{6}$, and the remainder is thrown into pannels which have a full length figure painted in each, and between these pannels are heavy stucco ornaments. The cove occupies $\frac{1}{3}$ of the whole height, or ten feet. In the chimney piece the opening has an architrave round it, an enriched truss on each side, an entablature with a plain slab in the middle. On each side of this stands a full length figure, holding a cornucopia, &c. and behind these figures there are two small Corinthian pilasters; upon this entablature is an open scroll pediment, and the family arms, which reach to the great modillion cornice. The middle door, at the end, has Corinthian columns, an open pediment, and arms, &c. over it. This description will convey an idea of the manner adopted by this architect, in finishing a magnificent apartment.

Hopeton House.

About half a century afterwards, a similar progress was made in Scotland; for Hopeton House, on the bank of the Forth, was begun in 1698, from a design by Sir William Bruce. The main building consists of a low basement, and two stories; the two principal stories have their windows of nearly an equal height, the lower windows have a level cornice, the upper a narrow architrave only round them; the colonnade which unites the main building and wings is convex. The hall in the east front is 34 × 25, that to the west 28 × 25; there is one apartment 31 × 21, another 23 × 19; one bed-room 21 × 18, and an octagonal stair 18 × 16.

Melville House.

About the same time Melville house, the seat of the Earl of Leven, was erected by Mr James Smith, viz. in 1692. It consists of two principal stories, a basement, and attic; the two middle rows of windows are nearly of the same height, viz. 9 × 3.3 feet; the whole front is plain except belts between the windows, rustic quoins, and small Ionic columns, and a circular pediment over the entrance door; the roof is deep, with tall chimney tops; the hall or saloon 45 × 24, smaller ditto, besides stair, 24.6 × 17.6; staircase 26 × 24; two apartments 25 × 20; and two 22 × 20.

Chatsworth.

Description.

In 1681, Chatsworth, the seat of the Duke of Devonshire, in Derbyshire, was begun by Mr Talman. The western front is elevated upon a fine terrace, which is ornamented with a range of rusticated columns, having pannels between them, and protected on the top by an iron railing. The basement of the building is rusticated; there are four Ionic columns in the central part, and four pilasters on each side of them; these are 39 feet high, and include two stories; the windows are rectangular, but deformed with clumsy key-stones; there is a pediment upon the before mentioned columns; upon the entablature there is a high plinth and parapet, with balusters and vases. In the southern front the basement is rusticated; there are four Ionic pilasters at each extremity, but none in the middle; the windows are rectangular with clumsy key-stones. In the principal story, which is 18 feet high, there is a hall 74 × 30; a gallery 90 × 22; a library 50 × 25; another apartment 40 × 23; a bed-room 23 × 22; a chapel 50 × 26; and a staircase 30 × 22; the passages are 11 feet wide. The interior square which the buildings encompass is 96 × 75. From the size of these apartments it will be seen that this mansion is upon an extensive scale, and from the western front being elevated on so fine a terrace, its external appearance is magnificent and commanding. In works of great grandeur, a terrace, judicially managed, always confers dignity, and is, besides, the means of obtaining commodious access to the domestic offices in the lower story.

Dimensions.

Montague house, or British Museum, resembles a French palace.

Before we take leave of the 17th century, we shall give a short description of Montague-house, now the British Museum in London: Being on the model of a French palace, it is a specimen of the architecture then practised in that country. It was built in 1678, under the direction of Monsieur Pouget, a native of Marseilles, brought to England on purpose by the first Duke of Montague; the plan and elevation will be found in Plate CLXXXI. The buildings surround three sides of a court, which is 165 × 155 feet; on the side next the street is a high brick wall, having its external face worked in pannels, having also an entablature worked in brick; in the middle of its length is an arched gateway with Ionic pilasters and a pediment, standing between two small porters lodges, which project outward before the face of the wall; over this gateway is a cupola with a Saracenic dome; at the distance of 16 feet from the inside of this wall, a row of Ionic columns supports a roof and forms a portico, which reaches between the wings; these wings, on each side of the court, are composed of a range of narrow buildings one story high, which contain stables and various small apartments for domestics; on the right hand side is a carriage way from the court; towards the street these wings terminate in turrets rising above the outer wall, with deep curved roofs, ending in narrow points. The fourth side of the court is occupied by the main building, whose extreme length over the walls is 216 feet, its breadth 64 feet; along the whole length it is divided by a brick wall running nearly in the middle of its width; and, with the exception of the great staircase, the whole is subdivided by walls passing quite across in a right line between the outside walls, by that means forming the apartments on each side of the middle walls of nearly equal dimensions; the staircase, in its length, occupies the space of two apartments. Nothing can exceed the simplicity of this arrangement, but it unavoidably subjects all the apartments to be thoroughfares, which,

PLATE CLXXXI.

Description.

although suitable to its present destination, is by no means comfortable in a private dwelling. The great staircase is spacious, and decorated with large historical paintings by Charles de la Fosse, who is considered one of the best colourists in the French school. The landscapes are by James Rosseau.

Dimensions.

The hall is 35 × 27 feet; stairs 52 × 25; apartment opposite entrance hall 35 × 28; two others 30 × 28; four others 26 × 24; and two 24 square; the length of the front or entrance stair is 34 feet; it rises the height of the basement, which is 8 feet. The face of the main building has a break in the central part or projection, and another at each extremity; it has a rustic quoin at each angle; it consists of two stories, of which the upper windows are considerably the loftiest: They are rectangular and plain. The entrance door is rectangular with a flat cornice and deep frieze; the entablature along the top of the walls is heavy, and has a very singular sort of trusses; the roof is deep, with Dormer windows, having pointed pediments; over the central break there is a parapet with balusters, and behind this there is a singular sort of heavy square dome, with the appearance of rustics at the angles.

Sir J. Vanbrugh.

The 18th century was opened by Sir John Vanbrugh, a man of bold and original genius, who, after having restored fresh life and reputation to the English stage, introduced into its architecture a style peculiarly novel and imposing. It is probable that the success of his dramatic pieces had inspired boldness, and created that fertility of invention so eminently displayed in his architectural works; and the number and wealth of his employers afforded, in the course of a few years, sufficient opportunities to exhibit splendid specimens of his skill; for, in 1713, we find him employed upon Kings Weston, in Gloucestershire; in 1714, upon Castle Howard in Yorkshire; in 1715, upon Blenheim in Oxfordshire; in 1718, upon Eastbury in Dorset; in 1721, upon Seaton Delaval in Northumberland; and in 1724, upon Grimsthorpe, in the county of Lincoln. We shall give a short account of each, and a Plate with a part of the plan and elevation of Blenheim.

Kings Weston.

Kings Weston consists, as was general in that age, of a large hall, passage, and stair, which occupy the central third part of the mansion; but the apartments are so arranged as each to be entered separately, a measure [illegible] L. D. H. [illegible] rather new. The hall is 36 × 29 × 30; there is one apartment 29 × 21; one 22 × 20; three 21 × 20; one 21 × 18; and the rooms in the upper story are of similar dimensions.

The front elevation extends 90 feet; the basement is low with small windows; upon this six Corinthian columns occupy the central part, including two stories in which the windows are of equal height. Over the entablature is an attic with windows; there is a large semicircle in the pediment; upon the attic is a parapet; over the extent of columns is a tall arcade finished with embrazures; exclusive of this arcade, the top of the front is a level line with vases; the roof is hid; the windows have flat segment tops, also plain dressings round them, and a small truss under each jamb and sill.

Castle Howard.

Castle Howard, including offices, exhibits a front extending 660 feet; it resembles Blenheim; but here the central part of the elevation is more predominant. The order is Doric in coupled pilasters, but they are too much disconnected by breaks, and omitting the triglyphs. In the garden front, the central part is occupied by Corinthian pilasters, reaching from the top of the basement to the top of the edifice, including two full stories with a pediment; over this are four pilasters, and a cupola with statues; on each side the central part, one story only is extended above the basement; but this affords room for one range of very fine windows being continued along the whole of this extensive front, and conveys an idea of this space being occupied by one suite of apartments. The basement is rusticated, but, including a high plinth, is not one half the height of the order. The architrave round the entrance door is rusticated: the windows are all arched; they have imposts and small architraves, but no clumsy arch-stones. Upon the whole, this garden front is simple and fine.

The hall is 40 × 34 feet; saloon 34 × 25; one apartment 27 × 22; one 30 × 20; one 30 × 25; one 25 × 20; rooms at extremities 40 × 15 exclusive of bows; the chapel 50 × 31; kitchen 33 × 29.

Eastbury.

Eastbury, the front of the main building, has a portico of eight rusticated Doric columns 35 feet high, standing upon a front stair, the steps of which are upwards of 50 feet long; the jambs of the windows are rusticated.

There are two halls, one 55 × 26; one 28 × 26; two great stairs 23 × 18; one apartment 44 × 22; one 26 × 22; one 24 × 22; one 28 × 22.

Seaton Delaval.

Seaton Delaval. The main building is of the castle sort, with turrets at the angles, and projections at the middle of the sides, but has Doric rusticated columns and a pediment, also Ionic columns in the other front; the face of the wall is plain. The lower row of windows have pediments; the other flat entablature all have architraves with small corbels under the window sills. There is a semicircle in the pediments in the centre, and Venetian windows in the turrets at the angles; each of these turrets have four large torus mouldings at its base.

Grimsthorpe.

Grimsthorpe is a quadrangle, encompassing a court 105 × 78 feet. The garden front has an elegant Corinthian portico standing upon a well-proportioned basement, it being only about one half the height of the order; the hall 57 × 38; at each end of it two rows of pillars divide off two great stairs; there are eight niches in the back wall. The apartments at each end of the hall is 35.8 × 27; the large room 55 × 25; two 28 × 27; one 27 × 25; one 23.7 × 25; one 26 × 24; one 24 × 20; two 24 × 18; two 20 square; the hall to the garden front 35 × 20; gallery in the same front 105 × 15.5, exclusive of a passage at each end and a recess 35 × 10 in the middle. This is an extensive and excellent plan; passages down each side prevent thoroughfares.

Blenheim.

General remarks.

But even these magnificent edifices are greatly surpassed by Blenheim, in which this able architect has created both a magnificent palace and a splendid triumphal trophy. It has been observed by a very able critic, (Knight on *Taste*, p. 227.) that even in chusing the situation, Vanbrugh has, with great judgment, selected the place where a splendid mansion will, in a picturesque scene, form the finest feature; wisely considering that it was not necessary that the finest views should be had immediately from the mansion, but rather by means of walks laid out on purpose.

Description.

The buildings occupy three sides of a square entrance court. The mansion stands upon one side; the kitchen court on another; the stable court on the third; and the fourth is open towards the water and great bridge. The ends of the building which forms one side of each of these courts, make a part of the general elevation; and this elevation altogether extends 490 feet. The whole extent over all the courts measures 850 feet. Not being

Plate CLXXIX.

able to convey a distinct idea of this elevation, or the arrangement of the apartments, in words, we must refer to (Plate CLXXIX.), where a particular representation will be found. In the central part of the entrance front, the Corinthian columns and pilasters, standing on a low basement, and rising to 40 feet in height, are magnificent features, and the varied ornamented outlines of the top are truly magical. If there is any defect in this singular elevation, it arises from the central part not having sufficient elevation and mass in proportion to those in the square and pyramidal turrets towards the extremities. In the garden front, the outlines are equally fine; and the long range of windows in the principal story, have a singularly good effect. The basement is in good proportion to the superstructure, but is injured by the small circular windows. In both fronts, all the porticoes have, very properly, pilasters at the extremities.

Dimensions.

The following are the dimensions of some of the apartments in the principal story: The great hall 55 × 44; saloon 44 × 35; principal stairs each 33 × 11; great gallery 183 × 21 at the narrowest part, and 28 at the broadest; the vestibule, including the bow, 41 × 18; anti-rooms each 32 × 25; drawing room 32 × 22; little dining-room 32 × 18; grand cabinet 26 × 26; bed-room 26 × 20.

General observations on Vanbrugh's architecture.

In the works of this able architect, we find the following fine features: extensive front stairs, low basements, orders rising each to the height of two lofty stories, upper windows of as great a height as those in the first story, and a varied and ornamented outline at the top of the edifice. He is singular in using pilasters at the extremity of porticoes and colonnades. In the latter they are most correctly placed, in the former we know of no classical architype; but in his great works, where strength and durability were apparently the principal objects, even this deviation appears defensible; in short, every external feature contributes to produce an imposing effect. Internally, at the same time that he has presented the means of exhibiting extensive suits of rooms, by connecting doorways, yet by the judicious arrangements of passages and staircases, he has generally obtained a separate access to each apartment. In the management of the detail, he has been accused of unnecessary clumsiness. In some cases, this criticism is certainly just, but we are to keep in mind, that the scale he worked on admits not of comparison with little things. He perhaps may, with more justice, be reckoned a mannerist: Blenheim seems never to have been absent from his mind when forming designs, for he is always gigantic, but also always bold and imposing.

Earl of Burlington.

About this time architecture in England received much encouragement, and was considerably improved by the indefatigable exertions and liberal patronage of the Earl of Burlington; we shall, therefore, in order to convey an idea of his taste, give some account of his town residence in Piccadilly, London, which, in 1717, was new modelled by him.

Burlington House, Piccadilly.

Description.

The court which the buildings encompass is 180 feet by 130. It is divided from the street by a high brick wall, in the middle of which is a magnificent arched gateway of the Doric order, ornamented by a peculiar sort of rusticated work. Immediately within this gateway, on each hand, is a circular Doric colonnade, which altogether makes a semicircle. The passage under these is 15 feet wide. The kitchen offices occupy the left hand side of the court; the stables the right. At each end of these ranges there are separate entrances, and a short arcade connects them with the main building. The middle part of the main building is 86 feet in length; at each extremity 25 feet projects 10 feet before the middle part. The whole length over the walls is 130 feet; the breadth at the extremities 66 feet; in the middle part 58 only.

Dimensions.

The hall is 30 × 20 feet; saloon 20 × 20; apartment right hand side of the latter 28 × 20; that on the left 20 × 18. In the division, next the left hand extremity, are two 20 × 20; one 20 × 13; one 18 × 15; the great staircase 24 × 21. In the right hand extreme division is the chapel 40 × 20. The kitchen is 31 × 18.

Remarks.

In the elevation, there is at bottom a plain plinth about 4 feet high, the top of which is the level of the first floor, and up to this level there is a front stair, the steps of which are 31 feet long; and as it is all without the face of the projections, at the extremities its landing forms a terrace between them. The face of the first story is rusticated, and, including the plain belt which passes along the top, is 15 feet in height; in this story the windows 8.3 × 4 are rectangular with three heavy key-stones in each lintel. Upon the before-mentioned belt course, rises the Ionic order, which, including the entablature, is 24 feet 6 inches high. In the central part of the building are 6 three quarters columns, upon each of which the entablature is broken. In each of the projections at the extremities, there are two couple of pilasters, without any breaks over them. Within this order there is one row of windows; those in the middle division are rectangular 9 × 4 with pediments, alternately pointed and circular. In each of the projecting divisions there is a Venetian window, arched in the middle. Upon the entablature, there is a parapet with balusters and small pedestals over the columns.

In the general disposition round the court, the colonnade within the gateway, as seen from the front of the main building, produces an elegant effect; but the kitchen is situated at a very inconvenient distance from the dining-room. In the main building, from the principal stair not being in the middle, the communications are incommodious, and its effect as a fine feature is lost. There is also too much thoroughfare, and the apartments are small. Externally, the front is generally well proportioned; the first story, which forms a basement for the order, is not too high, and the upper story being principal, corresponds with what we have frequently recommended. The windows should have been loftier, for there is too much dead wall over them; and not even statues on the top, is, in our opinion, a sufficient reason for breaking the entablature; for by so doing, the columns seem erected for this purpose alone, instead of being, as they ought, an essential part of the edifice. The assembly room at York, Lord Harrington's house at Petersham, the Duke of Richmond's at Whitehall, and General Wade's in Cork-street, were from his design.

Colin Campbell.

Wanstead.

During this period, Mr Colin Campbell also laboured with much zeal and perseverance. He published an account of many works performed by him: our limits will only permit us to notice Wanstead in Essex. This noble front extends 260 feet; the basement is well proportioned, being only 15 feet high. In the principal story is one row of very fine windows; they are rectangular, with pediments alternately circular and pointed. In the middle, there is a magnificent portico of eight Corinthian columns, three feet diameter, and a balustrade along the whole front. Internally, on the principal floor, there is a great hall 51 × 36 × 30; a saloon 30 × 30 × 30; two apartments 34 × 24; two 24 × 24; four 24 × 20; four 22 × 20; two 24 × 15; four 15 × 12. A library 34 × 24; and a chapel of the same dimensions. Many of those

Dimensions.

apartments are thoroughfares, particularly the library, which cannot be reached without passing through several rooms.

General observations.

Hitherto we have seen spacious porticos placed at an inconvenient distance from the ground; halls and saloons occupying a great proportion of the middle of the main building; most of the apartments rendered thoroughfares; ceilings thrown into deep compartments; walls covered with heavy tabernacle frames; and both these, and doors, windows, and chimnies, loaded with clumsy stucco ornaments: all this proves, that magnificence more than comfort or conveniency has been consulted. The imitation of the Italian arrangement and decoration seems also to have exclusively occupied the attention of the architect; but, having acquired a facility in the exercise of the art of imitation, the next step was to accommodate his works to the climate in which they were to be placed, and render them suitable to the wants and habits of the occupiers. This opened a new and extensive field for genius and taste, and the changeable disposition of a wealthy society afforded sufficient opportunities for introducing variety. We shall now give a short description of several mansions constructed in this improved style, and also adduce some engraved specimens.

Robert Adam. His style.

Amongst the earliest and most successful practitioners of this new mode, was Robert Adam: he discovered the impropriety of introducing into private dwellings the gigantic proportions and decorations of Roman temples; he noticed also the too rigid adherence to the Greek orders in all situations, however ill adapted; he endeavoured to correct these defects by introducing variety in his external façades, modelling pilasters, entablatures, sculptures, and other decorations to suit each particular work and situation. For the interior he introduced a greater variety of forms into his apartments, likewise light and gay finishings, as painted ceilings, slender mouldings, pilasters and friezes with light grotesque stucco and painted ornaments, and fanciful and delicate foliage. It cannot be denied, that he, in various instances, transgressed the limits of propriety; but is it surprising, that, immediately after having broken the trammels, he should not always confine himself within the strict boundary of correct taste? and it will be admitted that he is delicate and gay, even amidst a profusion of ornaments, many of which might have been spared; as at the entrance into the Adelphi, and the gate to Sion House.

Sion House. Dimensions.

Sion House, which Mr Adam, in 1762 began to fit up for the Duke of Northumberland, consists of a square of old buildings new modelled, within which he introduced a magnificent circular saloon. The external dimensions of the square, exclusive of the towers at the angles, are 163 × 140; the breadth over the walls of the entrance side is 38 feet; on the right hand side 28, on the left hand side 24, and the side opposite to the entrance 40 feet. The hall is 49.3 × 30, exclusive of a circular recess at one end, and a square one at the other; on the right hand of the hall is a square anti-room 39.4 × 26, with a peristyle of insulated columns; on the left hand is an anti-room of an elliptical shape, with $\frac{3}{4}$ columns attached to the walls. The buildings on the right hand side of the square are occupied by the great dining-room 62 × 22, including a semicircular recess at each end, divided off by columns, and a drawing-room 44.6 × 22. On the left hand side of the square there is a private eating room 32.6 × 28; a great staircase 29 × 20; a bedroom, anti-room, and dressing-room. One half of the breadth of the fourth side is occupied by a fine staircase, with private rooms for the Duke on each side of it; the other half is wholly occupied by a gallery 130 × 14.6, besides the towers at the angles, and a break in the middle. This last feature is purely in the stile of Spalatro. The saloon, which occupies the interior square, consists of two circles, the inner 50 feet, the outer one 70 in diameter; the inner is pierced by eight openings, each fitted with columns, and the piers with niches; the outer has four openings with columns, and the spaces between them are filled with niches and square recesses placed alternately, as in the Pantheon at Rome.—The exterior of this circular saloon being inscribed in a square, leaves four triangular courts, which are very convenient for affording light to the interior apartments of a great mass of building. The passage from the hall into this saloon, and from thence through well contrived entrances and a fine staircase into this extensive gallery, is certainly, for magnificence, as proper an arrangement as can be well imagined; and this is, in some measure, heightened by the irregularity of the floors which the architect found in the old buildings; but it is at the same time obvious, that for want of passages, the apartments are still too much thoroughfares; and judging from the plan in Mr Adam's book, there is some difficulty in conceiving by what means there is any communication between the great dining-room and the kitchen. Water closets are placed in different parts of this extensive plan; a conveniency unknown to the architects of former times. The delicacy of the interior finishings and furniture is equally novel in a British dwelling.

Observations.

Kenwood. Dimensions.

In 1767, Mr Adam was employed by the Earl of Mansfield, then chief justice of the King's Bench, to new model, and make additions to, his mansion at Kenwood. In this work the principle of thoroughfare apartments is abandoned, the hall is 31 × 21; great stair 27 × 14; the total length of the library is 61 feet, the square part part is 36 × 22: this last, which was wholly new, is a noble apartment; each end is formed into a semicircle, and filled with book cases; these ends being divided off by columns, leaves the middle in a square form. The entrance is through one of the circular ends: along one side of the square part, are three large windows; on the other side is the chimney, with an arched recess on each side of it: the ceiling is a plain trunk arch considerably below a semicircle. In the inside finishing of this room Mr Adam produced a specimen of what he wished to introduce into British mansions. The chimney, besides a delicately fluted architrave, has, on each side, a slender pilaster, richly ornamented in the pannels; an enriched tablet occupies the centre of the frieze; and on each side are a couple of sphinxes, with an altar between them: over the chimney is a large pannel, surrounded by an architrave similar to that of the chimney, and in it a portrait of Lord Mansfield, in his robes: the arched recesses have delicate ornaments very light and airy; a sofa stands in each. The book-cases are divided by enriched pilasters like those at the recesses, and over them, there are at each end pannels with suitable classical devices, represented by elegant figures in the Greek taste. The columns which divide off these book-cases, are fluted Corinthian, standing upon the floor, and with their entablature reaching to the springing of the arched ceiling. This entablature altogether does not exceed $1\frac{1}{5}$ diameter, the architrave occupies the $\frac{1}{5}$ only, and the frieze and cornice being $\frac{1}{2}$ diameter each; the frieze is enriched with lions and the heads of deer, in allusion to the family arms; the cornice has all the members except the corona enriched. The ceiling has first a bordering of honey suckles and similar flowers; the rest is distributed into delicate pannelling, diversified by square, oblong, circular and elliptical forms: in the middle of

Description of the library.

some of these are painted devices, in the other parts are stucco enrichments in the lightest grotesque style, and the whole was relieved by painting the grounds of the pannels and friezes; so that in this room the new mode was completely established.

External fronts.

Description.

Externally, the north or entrance front, extending 90 feet, has 40 feet in the middle occupied by a portico of four beautiful Ionic fluted columns, 28 feet 6 inches high, with a pediment, and at each extremity of this front there is a corresponding pilaster. This order standing immediately upon the ground, and reaching to the roof, has a proper character, that is utility. Within the portico, which is partly projecting, and partly recessed, there are only two rows of large windows, whereas on each side there are three rows of smaller ones. This arose from having an old building to work upon, but has the effect of destroying that monotony so frequent in large houses.

Remarks.

The south, or garden front, which, along with the main building, also includes the library on one side, and the green-house on the other, extends 240 feet. In the main building, upon a rusticated basement, 17 feet high, are placed ten pilasters, 21 feet high; six of these are in the middle, and two at each extremity of the main building; they are pannelled and ornamented with honeysuckles; over them are a frieze and cornice, which taken together, are little more than one diameter high; the frieze is ornamented with flutings and pateras; the cornice has every member, excepting the corona, enriched; this entablature appears too light for the order and edifice. An ornamented belt crowns the basement, and another divides the principal from the attic story, and there is, besides broad pannelling over the principal windows, enriched with what Mr Adam terms the flowing rainceau. If these last had been omitted, and the windows made loftier, the effect would have been improved. Along the library and green-house, which are only one story, there is a beautiful Ionic order, without any breaks in the entablature. In each of these buildings four columns occupy the middle space, and two pilasters each extremity, a mode worthy of attention. The order stands immediately upon the ground line, though it would have been preferable if there had been one course under it as a plinth. The entablature is $1\frac{3}{4}$ diameter high, it is enriched but not crowded, the whole is well proportioned, and would have been seldom equalled for simplicity of outline, if there had not been arches over each window, which mixes the Roman with the Greek architecture. The general effect of the whole edifice is also injured by the arched Venetian windows in the low part, which connects the main building and wings; and the whole of this façade, though fine, savours rather too much of the Dioclesian school.

We have been more minute in the details of this work, because, both externally and internally, it affords specimens of the architect's taste when left at full liberty, as, in this instance, he acknowledges it to have been.

Luton Park.

Plate CLXXX.

Dimensions.

In 1767, the Earl of Bute employed Mr Adam to make designs for a splendid mansion at Luton Park, in Bedfordshire; the whole of this work is, of course, original, and its principal or entrance front being singular for a private dwelling, we have selected it for engraving, as a specimen of the architect's best manner. We shall therefore refer to Plate CLXXX. and condense the description as much as possible. The entrance hall, which is forty feet diameter, pierced by four openings with columns, into recesses behind them, is altogether singularly fine; the saloon 64 × 24, appears to be too long, it seems, in this climate, to be space improperly lavished; the passage ten feet wide along the middle, renders the access to the apartments very commodious; the small courts are very convenient for affording light in a large building. The library, 143 feet long and 25 wide, besides recesses, is a magnificent suite of apartments; the dining room 43 × 25; drawing rooms 43 × 25, and 37 × 24; with the intervening anti or second drawing room 48 × 25; complete another suite of equal splendour; the stairs being each only 19 × 16, appear inferior to the size of the apartments, but there being one at each extremity of the middle passage, is a great conveniency. The principal floor is also well accommodated with water closets.

Remarks.

The principal front having no windows, except in the bows at the extremities, admits of a fine colonnade reaching between the bows, and this with the row of niches and statues, and large medallions over them, compose a façade seldom equalled even in public edifices. Here the colonnade, reaching from the ground to the roof, and having no break in the entablature, every member forms an essential part of the composition which apparently cannot be removed without involving the destruction of the edifice. We cannot, however, bring ourselves to admire the pateras which this architect so frequently plants upon his friezes; the windows in the bows want more height. The front to the park is very chaste, only the portico is unnecessarily confined upon too small a circle; the frieze is too gaudy, and the windows are too small.

Castle Coole.

Dimensions.

Plate CLXXX.

Remarks.

Of the still more modern mansions, which exhibit the prevailing modes in private dwellings, we shall select two examples of houses for noblemen, and two others on a smaller scale for country gentlemen. The first is a design of Mr James Wyatt, for Castle Coole, the seat of Viscount Belmore, in the county of Fermagh in Ireland. The main or central building is 115 feet in length, and 80 in depth; its middle part, in the entrance front, is occupied by a quadrangular hall 41 × 31; an elliptical saloon 36 × 30 extends to the opposite front; between them a passage, of eight feet in width, is divided from the hall by two whole and two semi-columns; on one side of the hall is a breakfast room, and on the other a library, each 36 × 24; on one side of the saloon is a dining and on the other a drawing room, each 36 × 24; between the drawing room and library is a very magnificent staircase 36 × 18, having its first flight of steps in the middle of the space; between the dining and breakfast room is a back stair 18 × 15, and a beaufitter 20 × 12 feet. On each side of the main building, the wings extend, nearly in a straight line with it, for 82 feet each; and they are each 52 feet in depth; on the entrance front immediately adjacent to each side of the main building, there is a green-house 52 × 15; behind these are passages seven feet six inches in width, and bed rooms and dressing rooms, each 21 × 20; also two water closets; the extremity of one wing is occupied by a nursery of three apartments, two 26 × 16, and one 18 × 12; the other extremity has a billiard room 26 × 16; a bed-room 26 × 16, and a dressing room 18 × 12. These apartments occupy the whole of the principal floor, (see Plate CLXXX.) In this design, for a nobleman, the apartments are upon a moderate scale, and are well disposed; the stairs are centrical; the bed-rooms and nursery are sufficiently retired; and the latter having a communication with the back stairs, relieves all the public apartments; the only matter not distinctly made out is the mode of lighting the passages. Externally in the entrance front, there being only four columns in the central portico, and these placed immediately against the pilasters, do not appear to form a feature sufficiently bold for the edifice. The colonnades of the green houses, and those in the extreme divisions of the wings with their accompanying niches, have a rich effect; there being four columns with two niches, and two square recesses at each end of the wings, that part is rendered sufficiently important; but the full columns being placed close to the walls, gives too much the effect of an unconnected screen. In the back front, the four columns placed upon the end of the elliptical saloon, seem upon too small a circle for Greek architecture. But, upon the whole, this building, both with regard to grandeur of effect and judicious arrangement, is well deserving the attention of the architectural student.

Roseneath.

Dimensions.

Plate CLXXXI.

Remarks.

The other example of a nobleman's house we have selected, is a design of Mr Joseph Bonomi, for Roseneath Castle, a seat of the Duke of Argyle, upon the banks of the river Clyde, nearly opposite to the town of Greenock. The whole length is 184 feet, the depth 66, besides projections of 11 feet in the central part of each front, the one square, the other circular, and each having before them an insulated portico. The chief peculiarities of this building are, its breadth being equally divided by a straight passage 11 feet 6 inches in width along the whole of its length, and having a driving way under the entrance portico. These circumstances render the arrangement simple and commodious. (See Plate CLXXXI.) The hall is 25 × 25; the vestibule 60.6 × 11.6; library 32.6 diameter, with two large circular recesses; dining-room 31.6 × 22; music-room 36 × 22; study 24 × 22; billiard-room 31.6 × 22; bed-chambers (upon this principal floor) 22 × 19.3; dressing-room 18.6 × 12, and 16 × 12. There are two water closets. The principal stair 32 × 12 has its access ill arranged, and is too confined. The back stair is placed inconveniently at one extremity of the passage. Externally, both fronts are decorated with columns, which produce a fine effect. The entrance portico consists of five columns, which would be an absurdity if the driving way was not designedly along the front, and under the portico. The front stair had better been straight than elliptical. This design displays originality of genius, and a disposition to simplify truly laudable.

Bowden Park.

Dimensions.

Remarks.

Of the smaller dwellings of country gentlemen, we may mention Bowden Park in Wiltshire, a seat of Barnard Dickenson, Esq. designed by Mr James Wyatt. The main building is only 70 × 57. The inferior buildings, containing the offices and a green-house 50 × 18, lie immediately behind, and encompass a small court. The entrance hall is elliptical 23 × 28, of which about 10 feet project before the line of the front. On one side of the hall is a dining-room, and on the other a drawing-room, each 30 × 20. Immediately behind it are a principal and back stair, a small lobby, and a china closet. A water closet projects from it into the court, but is entered from the staircase. The space occupied by the best stair (extension of the lobby 15 × 10 which is before it) is 22 × 15, of which the china closet occupies the space under the landing. The lobby or passage to the back stair and dining-room is 15 × 7. The back stair is 12 × 7. On one side of these stairs is a breakfast room, which looks from a circular end into the before-mentioned green-house; and on the other a library, each 20 × 20. The connection with the offices is by the back stair, into a passage which communicates with a butler's pantry 13 × 8, besides a closet, a housekeeper's room 18 × 15, with a store-room 12.6 × 8, and a pantry 12.6 × 6.6, a kitchen 21 × 18, with a scullery 18 × 8.6, a dairy 13 × 10, and a larder 10 × 6, a servants' hall 21 × 20, and a shoe-room 6 × 5. This appears to be an excellent house on a small scale, only the kitchen seems much too distant from the dining-room, and the servants' hall still more so from the entrance hall. Externally, we are rather surprised to find an architect of Mr Wyatt's acknowledged good taste, placing columns so frequently in the convexity of a circle, so narrow as that formed by the projection of the end of this entrance hall. The columns being carried up the whole height of the building, accords with our ideas of propriety.

Oxberton.

Dimensions.

Remarks.

The other instance of a moderate sized and very compact house, is exemplified in that of Oxberton in Nottinghamshire, designed by Mr William Wilkins for F. F. Foljambe, Esq. It occupies only a space 72 × 68, exclusive of a circular projection of a part of one side about 17 feet. The entrance hall is 20.6 × 16, on one side of which is a breakfast room 22 × 16, and, on the other, a cabinet for natural history 22 × 16. Immediately behind the hall are some small closets, and a small circular lobby 5.6 diameter. Beyond these is the principal stair 20 × 15.6. On one side of which is the drawing-room, with the before mentioned circular end, it is 36 × 24. On the other side is Mr Foljambe's dressing-room 22 × 14, and a passage 5 feet wide leading to the office. Behind these is a dining-room 30 × 22, and a library 28 × 19; also a passage between them 6 feet wide, leading to a small back porch. We are not in possession of the plan of the offices. This is an example of singularly compact arrangement, and proves the advantages derived by placing the stair in the middle of the house. We observe the want of a back stair. Externally, the whole is very plain, except a Doric portico of four columns 4 feet diameter, without bases, the shafts fluted to an edge. This portico occupies the whole height of the front, and being Greek Doric, appears two massive for so small a building.

Gladswood near Melrose.

In addition to these examples, we shall only mention an elegant small dwelling-house, which has lately been built by William Sibbald, Esq. on the north bank of the river Tweed, at a place called Gladswood, near Melrose in Scotland. The approach is so managed, that the entrance front has only the appearance of being one story high, and the public rooms and principal bed-rooms are upon the same floor; but the situation being on sloping ground, a space behind the house is cleared, so as to render the access to the domestic offices level and commodious. The front elevation is constructed with neatly cut and polished stone, and decorated with columns. This charming little villa stands on the external angle of a bend of the river, where the banks are singularly bold and well wooded. It commands a view of the town and abbey of Melrose in one direction, and also of the abbey of Dryburgh in another. The Cheviot Hills bound a distant prospect in front, while the north and east are protected by a chain of hills, and being immediately surrounded by well cultivated fields, and an excellent garden judiciously disposed, we consider this altogether as a perfect model for the villa of a small freeholder.

Conclusion.

We are convinced that the reader, who has attentively followed us through this discussion respecting private dwellings, will have a distinct knowledge of their progress since the revival of the arts. He will also admit, that sufficient specimens and explanations have been produced, to afford him a perfect conception of the present state and practice of the art, and that by means of the data here selected from the ablest masters, his own progress in designing and executing buildings will be much facilitated. We have placed before him the results of the experience of ages, and his own genius and reflection will enable him to proceed to a still higher degree of perfection.

City architecture. Bath.

A very excellent specimen of city architecture was displayed about the middle of last century by Mr Wood at Bath. The city at that time consisted of narrow streets and mean buildings. He commenced his operations, by covering the low grounds on the western bank of the river Avon with ranges of buildings, in a regular and elegant style of architecture. These were elevated about 18 feet above the level of the natural ground by artificial terraces raised on arches, and covered with smooth pavement, and were named Parades.

Parades.

That to the northward is 580 feet in length, and 52 in breadth.

Queen Square.

From these parades, after ascending the hill to the north-west of the old town, Mr Wood formed Queen Square, of houses upon a larger scale than those erected upon the parades, and more ornamented with Roman architecture. The upper or northern side of this square, consisting of pilasters, columns, and a pediment, and the other sides sufficiently varied, to avoid the dull monotony found in many modern improvements.

Circus.

Having by this step disentangled himself from the old town, he at some distance from the before mentioned square built a circus, 500 feet diameter, pierced by three spacious streets. Here he introduced a correct and very rich piece of Roman architecture. The houses being three stories above the level of the pavement, have their fronts ornamented by the three distinct orders of architecture, viz. the Doric, Ionic, and Corinthian, in coupled columns, having their entablatures passing along without any break, except where the façade is intercepted by the before-mentioned streets. The columns projecting before the face of the walls three-fourths of their diameters, they possess bold relief. The metopes of the Doric frieze, and mutules of the cornice, are enriched. The friezes of the other two orders are plain, but an enriched foliage passes in a range between the Corinthian capitals. The whole presents a bold and rich piece of architecture, and from each of the three streets the spectator has, when entering, a fine crescent opposed to him. But we cannot help noticing as a defect the want of a pier, where these fine façades terminate at the angles of each street. If the several projections had been thus covered, these orders, instead of resembling a screen, would have been converted into an apparently essential part of the edifice, and the piers would have still formed a sufficiently distinct partition from the great plainness of the adjacent streets.

Crescent.

From this fine circus Mr Wood passed, by one of the before-mentioned streets, to a piece of ground which commands an extensive view of the valley, and there constructed a crescent extending 670 feet. This consists of a plain basement story, supporting a row of semi Ionic columns placed at equal distances, excepting in the centre, where there are two coupled columns on each side of an arched window, all the other windows being square and plain. There is no break in either the basement or entablature. At each extremity there is a return on the chord line of the crescent (or segment) for the extent of the width of the houses. Here at each angle there is a column, which had better been a pilaster; but as the order and columns are returned on the back part of the houses, and are there terminated by pilasters, which are continued, the whole is thereby rendered an essential part of the edifice, and not a screen. The appearance of the shafts of the large Ionic columns now quite plain, would be much improved by flutings. This crescent, which contains 80 houses, is one of the finest architectural features in England.

New rooms.

Having thus formed a new creation of splendid dwellings, the architect, for the accommodation of the inhabitants, constructed new assembly-rooms on a suitable scale, in a convenient situation, on the eastern side of the circus. The ball room, is 105 feet 8 inches long, 42 feet 8 inches broad, and 42 feet 6 inches high; the octagon room 47 feet diameter; the tea-room 66×41; and the card room 60×30.

Old rooms.

These rooms were opened in 1771; the lower assembly-rooms adjacent to the parade, had been established 21 years before that time.

Remarks.

From these great leading features, other streets, squares, and crescents, which, though inferior to those constructed by Mr Wood, yet by no means deficient in architectural merit, have since been spread along the face of the hill, and also on the eastern, or Bathwick side of the river Avon, rendering the city of Bath a suitable reception for the wealthy and luxurious.

General observations.

It would much exceed our bounds to include in this article, a full description and comparative statements respecting city architecture, as practised in different ages and countries. We shall therefore content ourselves with stating, that, in the cities of London and Glasgow, some excellent specimens may be seen, of extending improvements upon a nearly flat surface; and that at Edinburgh and Bristol an instructive variety will be found upon hilly ground. We may have an opportunity of again taking up this subject, and entering more into detail.

OF GOTHIC ARCHITECTURE.

Gothic architecture.

The attention to Gothic architecture having only been lately revived, the practice has not hitherto been digested into a like systematic order as that of the Greek or Roman; and it is not a little extraordinary, considering that, during the ages in which it was extensively practised, its operations were directed by men of science and literary habits, that no written rules have been discovered in the religious houses, which were then the only depositories of knowledge.

No written rules.

Observations by Mr Knight.

This has led Mr Knight, and other men of observation, to assert, that each architect proceeded independently of rules, and worked in the manner which to him appeared best calculated to produce a striking effect, and that it was in consequence of the absence of determined rules, that this school rose to the degree of sublimity it attained.

Denied by Dallaway, &c.

This is denied by other able and enlightened men, who have paid much attention to the subject, especially Dallaway, Milner, and Hawkins, who maintain, that although few arranged rules and proportions have been published in books, yet that the architects and workmen were constantly guided by known rules agreeable to the prevailing mode.

Gothic changes compared with Roman.

It is evident, although not so rigidly confined as the Egyptian, that the Gothic architects were fully as much limited as the Roman; for the contrast between the massy plain Norman style, and the latter or florid Gothic, is not greater than what was produced by varying from the plainness, simplicity, and oblong forms of the ancient Greek temples, to the circular, delicate, and highly ornamented edifices of the latter Roman.

Free-masons.

The non-existence of written rules may also be attributed to a jealousy in the fraternity of free-masons, who spread over Europe, and were the persons chiefly employed in constructing the Gothic churches; and these men, when constantly so employed from age to age, had no more need of written rules than many other men confined to one profession, and probably to separate branches of it. We may bring forward as an instance, the most expert of our British shipwrights.

We shall now consider the practice of Gothic architecture,

1. As regards the general distribution of the ground plan, and elevation of the edifice.
2. The forms of the essential parts.
3. The decorations.

General distribution.

1. The Gothic style having been employed almost exclusively in edifices appropriated to the purposes of the Christian religion, the outlines of the ground plan have almost uniformly been a cross. In the Greek and Roman oblong temples, the ratio of the length and breadth was determined by the number of columns placed at nearly equal distances along the ends and sides, while that of the height was regulated by the diameter of the column; but in the Gothic, where seldom any columns have been placed on the outside of the edifice, and the use of arches proving a relief from constraint within it, it is alleged, that the proportion of the length to the breadth has been determined by triangles and squares. Of this, Mr Hawkins, in his History of the Origin and Establishment of Gothic Architecture, (chap. x.) has produced an early instance from Cæsar Cæsarianus, a celebrated architect of Milan, who, in an elaborate commentary annexed to his translation of Vitruvius, (printed in 1521, a copy of which we have seen in the hands of Mr Taylor of Holborn,) has explained the principles of Gothic architecture. For a full dissertation upon this part of the subject, we must refer to Mr Hawkin's excellent book, and shall here only give two diagrams from Cæsar Cæsarianus, drawn upon the plan and elevation of the church of Milan, with his description of them, which, though not very distinct, will serve to convey an idea of the principles he means to inculcate.

Cæsar Cæsarianus.

Plate CLXV. Fig. 1.

Rules exemplified in the church at Milan.

Plan.

In Plate CLXV. Fig. 1. "the letters ABC, BCD, EFG. and FGH, are four equilateral triangles. IJK are the boundaries at the east end. JKL form an equilateral triangle, which touches the line that passes through the two eastern middle columns. These last, by their correspondence with the other columns, not only divide the body of the church from the aisles, but settle the foundation for the square tower in the middle, and show how it is constructed, the centre of which tower is the letter M. In like manner, the letters INO form the other equidistant line which passes through the two western middle columns, the measure of which line, from the south to the north door, is 128 cubits, (of 25 inches each.) The letters PQR are an equilateral triangle of the measure of 64 cubits, as are also, and of the like quantity, the letters STM. The letters UVW are an equilateral triangle, from the centre of one to that of another of the columns, which form the range extending towards the west, the distance of which columns is 32 cubits. Where the letters XUW are found, are the different indications for the smaller intercolumniations, which are of the measure of 16 cubits, from the centre of one to that of the other pillar; and the letters ZA shew the intercolumniation of the columns, between which they stand. They ascertain also the outside extreme width of the door of the vestibule in the front of the nave, and regulate the vaultings of the arches over that part, in the centre of which is placed the letter B."

Elevation.

With regard to the orthography or elevation, (Fig. 2.) "the triangle is here marked at the base with the letters ABCDEF, and the point of it is to be found at B; a perpendicular from which is dropped upon the base line, and there distinguished by the letter H. But in order," says he, "to show the method by which the colossal figure at the top was regulated, and those marks to have the rules for the largest triangle, I shall extend the before mentioned triangle on one side from A to I, being a space of 16 cubits; and from F to J on the other side. Drawing a line from I to J, I shall gain the length for raising two other lines, which form the equilateral triangle on the before mentioned perpendicular GH, at the point K, the extremity of the arch called in the third acute or pointed. This triangle, if placed upon the range of capitals of the smaller columns, marked L and M, will touch, at its extremity, the letter K. In like manner, if I place over the former a triangle on perpendicular lines, raised from A and F, the base of which will be NO, and its point P in the perpendicular PH, which forms the largest triangle QRP, I shall then have the base NO, resting upon the arch of the nave; which base, by touching the extreme line of the building, ascertains, with the letters ST, the place where the top of the border is to be; so do also the letters UV, a little distant from them, as to the border a little above. The letters XY give the base of a triangle on the capitals and upper vaulting; which upper vaulting is compacted together with an iron chain. Every vaulting of the arches is constructed by the compasses placed on an acute triangle, the strength of which, for supporting a weight, is always greatest at the top; but if the weight be placed a little on one side or other of the centre, the arch is easily broken. The method of placing an octagon tower on a square raised from the solid, is shewn by the letters UVW; and within the spaces LZ and MA is the range of lowest windows."

Dimensions.

The dimensions of this magnificent edifice are stated, on the authority of Carlo Torre, to be, from the modern front to the wall of the choir, more than 260 cubits, (of 25 inches), the length of the choir 60 cubits, and its width 28; the middle nave 32 cubits wide, and 85 high to the vaulting; the two side aisles next this nave are each 16 cubits wide and 60 high; and the two outermost aisles are each 16 cubits wide and 50 high. The vaulting of the Louvre is 130 cubits. It is supported by four columns larger than the others; upon these arches the cupola, which is octagonal, rests. This cupola is 202 cubits high from the ground. The columns or pillars are 52 in number, and, including the base and capital, each 46 cubits high, of which the base is 2 and the capital 10 cubits. These columns are each in girt 13 cubits, and the four columns under the cupola are 15 cubits girt at the capital and 22 at the base; they are clustered eight shafts in each.

Dome of Sienna.

Rules referred to.

Mr Hawkins, in the same chapter, (x.) likewise relates, upon the authority of Della Valle, his letters *Sensi*, vol. ii. that, in 1321, during the erection of the dome of Sienna, six architects were appointed to examine the work, who reported, as their opinion, that the new work should not proceed any farther, because, if completed as it had been begun, it would not have that measure in length, breadth, and height, which *the rules of a church require;* and, they farther added, that the old structure was so justly proportioned, and its members so well agreed with each other in breadth, length, and height, that if, in any part, an addition were made to it, under the pretence of reducing to the right measure of a church, the whole would be destroyed. Here *the rules for a church* are distinctly and repeatedly referred to, and must therefore have existed.

Willis on Abbeys.

Browne Willis, in the preface to his History of Abbeys, vol. ii. states, that in the most stately abbeys, the height was equal to the breadth of the body and side aisles; that the steeple and towers were frequently in height equal to the length of the whole fabric, or sometimes to the cross aisles from north to south, as in Bristol, Chester, St David's; that the cross aisles often extended half the length of the whole fabric, as did the nave or western part, that is, from the great door at the west end, to the lower great pillars which supported the steeple; that the side aisles are half the breadth and height of the nave. But the following dimensions of cathedral and conventual churches will better enable the reader to judge of the relative proportions of the great members of these sacred edifices.

Rules exemplified in York Cathedral.

In the cathedral of York the lengths of the nave and choir are determined by equilateral triangles, formed upon the whole extent of each side of the transepts, which terminate upon a line drawn across the face of the buttresses, at each end of the nave and choir.

Dimensions of Cathedral Churches in feet.

Names.	Nave.			Choir.			Aisles.			Transepts.			Our Lady's chapel.			Cloisters.			Chapter house.			Tower.			Total dimensions.		
	L.	B.	H.	L.	B	H.	L.	B.	H.	L.	B.	H.	L.	B.	H.	L.	B.	H.	L.	B.	H.	L.	B.	H.	L.	B.	H.
Bath	136	72	78	75	35	73	112 80	21 21	38 38	46 46	48 28	74 74	None.			None.			None.			20	301	150	210	120	—
Bristol	75	73	41	100	—	43	included.			128	—	43	do.			103 square			46	26	—	—	—	127	175	128	—
Canterbury	214	94	80	150	40	—	do.			154 upper. 124 lower.			150	—	—	134 do.						S.W. N.W. Central Do. diam.		130 100 234 35	514	154	—
Chichester	205	91	61	100	62	—	do.			131	—	—	87	21		N. to S. W. E.		120 100 128				W. end Belltow. Spire ad.		95 107 270	410	131	—
Durham	260	74	64	120	74	71	do.			176	57	—	131	51	—	147 square.						W. Central		143 214	420	176	—
Ely	203	73	104	101	34	70	do.			—	178	—	100	46	60	100	150	0				W. front		215	517 535 outside.	178 190	6 —
Exeter	180	40	68	132	34	68	148 132	20 20	35 35	140	32	68	65	35	40	133 square.			55	32	50	28	28	145	390	140	—
Glocester	171	41	67	140	34	86	N. 171 S. 171	21 22	40 40	66	43	78	92	24	46	144 148	19 —	18 —	New Library.			—	—	225	426	152	—
Hereford	144	68	68	125	20	64	144	—		140 111	— —	— —	71	30	28	115 square. destroyed.			Octagon, destroyed.			Anc. sp. taken down.		240	325	100	—
Lincoln	260	85	83	235	75	—	included.			235	75	—				120	100	0	Decagon. 65 diam.			W. Central		260 288	498	227	—
Litchfield	213	67	67	120	33	67	do.			88	—		55 35	Presbitry.								W. Central		183 258	411	88	—
Old St Paul's	335	91	102	168	—	88	do.			297	—	—	92	—	—	91 square. destroyed.			Octagonal.			Tower Spire Total		260 274 534	631	297	—
Norwich	230	71	—	165	—	—	do.			191	—	—				170 square.						—	—	317	411	191	—
Peterborough	231	78	78	138	78	78	do.			69	203	78	80 taken down	—	—	138 destroyed.	131	0	84 destroyed.	33	—	Two sp. Tower		156 150	480	203	—
Rochester	150	65	—	156	—	—	do.			122	—	—										—	—	156	306	122	—
Salisbury	246	76	84	140	—	84	do.			210	60	84	65	—	—	160 square.			Octagonal.			Spire		410	452	210	—
Wells	191	67	67	108	67	—	do.			135	—	67	47	33	—							W. Do. Center		234 130 160	371	135	—
Winchester	247	86	78	138	86	78	do.			208	—	—	57	—	—	179 square.			Octag. 90 destroyed.			—	—	133	554	208	—
Worcester	212	78	72	126	93	—	do.			128 120	32 25	— —	60	49	—	120	125	0	Decag. 58			—	—	196	410	128	—
York	268	55	102	162	55	102	—	25	40	60	90	96	70	55	102	None.			Octagonal. 63	63	68	Façade & tower Central tower		198 234	524	224	—

Dimensions of Conventual and Collegiate Churches in feet.

Reading, nave 215, choir 98, transept 196 × 56. Our Lady's Chapel 102 × 55, total dimen. 420 × 196.
Cirencester, choir 132 × 66, cloister 104 square, chapter house 42 × 30, do. 280 × 92.
Tewksbury, total dimensions 300 × 120; nave, including the aisles, 70 broad.
Malmsbury, do. 100 × 60. Winborn in Dorset, do. 180 × 60.
Kirkstall, Yorkshire, do. 224 × 118. Lanthony in Monmouthshire, do. 210 × 100.
Fountains, do. 351 × 65 including aisles, transept 186.
Glastonbury, nave 220, breadth, including side aisles, 85, choir 155, transept 220, cloister 220 square, total dimensions 420 × 220.
Selby, Yorkshire, nave 50, total 267 × 100. St Albans, nave and side aisles 72 wide, total 550 × 217 × 65.
Tintern Abbey, do. 40, do. 225 × 150. Netley, Hants, do. 60 do. 200 × 160.
Beverley Minster, do. 63, do. 333 × 165, western tower, which was trussed up, 198 high.
Westminster, nave, length 130, breadth, including side aisles, 96, height 100; choir, length 152, cloister 141 × 135, transept 189. King Henry VII.'s chapel 100 × 66 × 54 high, total 489 × 189.

Dimensions of Cathedrals in Foreign Countries.

Antwerp, total length 500, transept 330, height of spire 360 feet.
Rouen, do. 408, breadth of nave and aisles 78, height 100 feet.
Notre Dame, do. 414, do. do. 153
St Ouen, do. 416, transept 234
Batalha, do. 541, do. 416
Seville, do. 420, do. 263 height 126
A Moorish tower built of brick, do. 350
Milan, do. 554, width of nave and side aisles 183, vaulting 184, cupola, 438

Essential parts.

1st order.

2d order.

3d order.

With regard to the form of the *essential parts,* they are mostly defined in the following description of the three orders of architecture, as given by Dr Milner in his reply to Mr Whittington; the *first order* is characterised during its formation, that is to say, till near the latter end of the 12th century, chiefly by its acute arch (its pillars and other members being frequently Saxon,) but after its formation, not only by the narrowness and acuteness of its arch, but also by its detached slender shafts, its groining of simple intersecting ribs, its plain pediments without crockets or side pinnacles, and its windows, which were either destitute of mullions, or have only a simple bisecting mullion, with a single or triple trefoil, quatrefoil, or other flower, in the head of them. Of this order are the east end of Canterbury, the west end of Lincoln, and the whole of Salisbury cathedrals, besides the transepts of York Minster, and of Westminster Abbey. The *second order* is marked, not only by the fine turn of its perfect equilateral arch, but also by the cluster columns being, for the most part, formed each course out of the same stone; by the elegant, but not over crowded tracery of its windows and groining; by its crocketted pinnacles, tabernacles, and pediments, the latter of which, towards the conclusion of the fourteenth century, were made with an ogee sweep towards the arch they covered. To this order belong the nave of Westminster Abbey, the nave and choir of York Minster, the naves of Winchester, Exeter, and Canterbury cathedrals, Wykeham's two colleges, St Stephen's chapel, &c. The *third order* is known, not only by the flatness of the point of the arch, but also by its numerous, large, and low descending windows, together with the multiplicity and intricacy of its tracery; by its pendents from the roof; by the minuteness and profusion of its ornaments, both exteriorly and interiorly; by its fan-work and numerous shields and devices on the ceiling. To this order belong King's College chapel Cambridge, St George's chapel Windsor, and King Henry the VII's chapel Westminster.

Spires.

One of the finest features of Gothic architecture, and which, in many instances, still forms the most striking ornaments of our cities, is the tall tapering spire, which was first built of wood by the Normans, and afterwards in stone early in the 13th century. In the course of the 14th and 15th centuries, they were greatly increased in number. The following are the most noted.

	Height of tower.	Height of spire.	Total.	When built.
Old St Paul's	260	274	534	1221 of wood, and covered with lead.
Salisbury	207	193	400	1280 of stone.
Norwich			317	1361 ditto.
St Michael's, Coventry	136	164	300	1395 ditto.
Lowth, Lincolnshire	148	140	288	1516 ditto.
St Mary, Shrewsbury	76	140	216	1590 ditto.

St Alkmond, Salop.

Although the loftiness of these spires produces a very striking effect, yet it must be evident, to the most superficial observer, that much also depends upon the relative dimensions of the tower and spire. The following are taken from the church of St Alkmond, in the town of Shrewsbury, which, though not remarkable for magnitude, is reckoned, by persons of good taste, to possess singular elegance of form. The height of the tower, from the surface of the ground, is 70 feet, and it is 22 feet square on the outside; the height of the spire is 114 feet, and its diameter at the base 19 feet.

Foreign spires.

Inferior to the English.

On the Continent there are some also of great height; that at Vienna being 465, and at Strasburgh 456 feet; but in those, as well as at Rouen, Constance, and Bayeux, in France, from the diminution commencing at the base, the general outline has not the same degree of elegance as the English, which are elevated upon lofty square towers. Some of the latter are constructed with walls of incredible thinness, Salisbury spire being only seven inches. The finest effect is produced by spires whose outlines are quite plain, as those at Shrewsbury and Worcester. St Michael's at Coventry is hurt by sculpture.

Towers.

Many of the Gothic structures have very lofty square towers only, some highly decorated. The tower of the fine church at Boston in Lincolnshire, finished by an octagonal louvre, is 282; Lincoln 288; Ely 270; Canterbury 235; York 234; Gloucester 224; Durham 210; Beverly 198; St Nicholas, Newcastle-upon-Tyne, 194; Derby 174; Taunton 153; Doncaster 152; Radcliffe, Bristol, 148 feet in height.

On the Continent; the tower built at Florence by Giotto in 1334, is 264 feet, diameter 46; the falling tower of Pisa, 188; the center tower of St Owen at Rouen, which is octagonal, and built in 1309, is 240 feet.

Observations.

This variation in the style of ecclesiastical architecture, as it regards spires and towers, is very evident in different parts of England. In the counties of Northampton, Leicester, and Huntingdon, spires are found almost in every village. Whereas in the counties of Lincoln, Suffolk, and Somerset, towers generally prevail.

Of columns.

Rules for disposition.

In Gothic architecture, the columns, arches, some particular moulding and buttresses, are members which require to be noticed. With regard to the distribution of columns, it has been observed, that the rule, in our finest cathedrals, has been to divide the whole extent from north to south; that is, including the length of both transepts and the breadth of the choir, into ten parts; three of these parts or arches were given to each transept, one to each side aisle, and two to the nave or middle aisle; that the breadth of the side aisles determined the distance at which the columns were placed longitudinally. Perhaps the general mode of distribution may be explained in a still more simple way, by dividing the breadth of the nave into four, or, in some cases, as in the before-mentioned great church at Milan, into six equal parts; but, in order to obtain more free space, omitting the row of pillars which would, by this

Hint for pointed arches.

mode of division, have occupied the middle space, and which the use of arches enabled the architect to do without inconvenience. It may here be also, without impropriety, noticed, that attempting to make the narrow side arches as high as those over the middle space, may possibly have first suggested the idea of pointed arches.

General observations.

In respect to columns, conclusions have too generally been drawn, from considering the slender purbec marble columns (which are, in some instances, attached to a large central cylinder,) separately, or otherwise, by taking by itself each column of the great clustered pillar; and being thereby astonished at proportions in which the height is sometimes 120 diameters. But this is fallacious, because there ought, in a comparison of height with diameter, to be included the whole mass of which the pillar is composed, and from which the incumbent weight derives support; and when viewed in this manner, the pillars used in Gothic buildings will not much differ in the ratio of their height and diameter from those employed in the Roman architecture.

Rules for height.

In the cathedral of Milan, the height of the column is one-third of the whole extent across the edifice, at the transepts, viz. $\frac{138}{3} = 46$ cubits of 25 inches each; and this height is $7\frac{2}{3}$ diameter, of which the base and capital each occupied $\frac{1}{3}$ of a diameter. The four large columns in the Louvre were $6\frac{9}{11}$ diameter, of which the cap was $\frac{21}{100}$, and the base $\frac{8}{11}$ of a diameter.

Ratio between height and diameter.

Two pillars in Westminster Abbey were carefully measured by Batty Langley in 1742. They each consist of a large central cylinder, having four slender columns attached. The height of the central cylinder of one, which was erected in the time of Henry III. about 1240, is, including base and capital, five diameters of the whole cluster, and $7\frac{3}{7}$ of the central cylinder; the base is $\frac{7}{11}$, and the capital $\frac{1}{4}$ of a diameter. In the other, which was erected in the time of Edward I. the central cylinder, including base and capital, is five times the diameter of the whole cluster, and $8\frac{2}{11}$ times that of the central cylinder; the base and plinth is one diameter, the capital $\frac{1}{2}$ a diameter. These instances are sufficient to enable the student to pursue this mode of investigation, for which recent publications, respecting the English cathedrals, will afford sufficient data. We shall add another instance, which may lead him to consider this part of the subject in a still more important view.

Church of Toussaint at Angers.

In the church of Toussaint at Angers, a space, which is 63 feet in length and 31.6 in breadth within the walls, is vaulted by groin arching, of which the ribs are of a hard stone, cut and dressed. The interstices are filled with small rubble stone five inches in thickness. The arch over the middle space is 26 feet in height, the side arches each 13 feet. The whole of the central parts of this vault rest upon two columns, each 24 feet in height, and only eleven inches diameter. They stand in the middle of the breadth, and 15.6 distant from each end of the apartment. It is calculated, that the weight resting upon these columns is equal to 127,660 pounds. By experiments upon stone, similar to that with which the columns are constructed, each superficial inch carried 6650 pounds before it was crushed; but taking one half of this weight, the superficies of each column is 95 inches, the two 190; they should therefore support 632,750 pounds, or $4\frac{1}{2}$ times what they do. The walls of the apartment are $4\frac{1}{2}$ feet in thickness. Useful information may be derived from similar calculations upon English chapter-houses, supported by one or more columns. In the article BRIDGE, it has already been stated, that in the octagonal chapter-house at Elgin, the pillar bears more than 40,000 pounds upon every square foot, and when its roof was perfect the weight must have been considerably more. This middle pillar is 24 feet in height, and the ribs spring from each angle of the octagon.

Two very slender columns.

Calculations respecting the weight supported.

Elgin chapter-house.

Norman columns massive and decorated.

The Norman columns were generally even more massive than the Saxon had been. They sometimes consisted of a single shaft, cylindrical, hexagonal, or octagonal, not unfrequently fluted in a spiral direction, or embellished with lozenges or network in alto or bas relief, which rivalled the richest of the Palmyrean or Dioclesian pilasters. The body of the pier was sometimes a compound form, rectilinear or curvilinear, or having portions of columns upon two or more sides; and sometimes having two or more large columns joined together, with or without angular parts between them; or there was a large square or octagonal pier, with slender round columns at each angle. The capitals were plain, or a sort of volute, or consisted of flowers, leaves, shells, or heads of animals; and of these, varieties in the same row was not uncommon. These columns had scarcely any regular base, but rested on a plinth shaped to suit the shaft.

1st Gothic order.

The first deviation from the Norman was into 8, and soon afterwards, there was formed a central cylinder with slender shafts attached to it. These were divided in several parts of their height by small fillets; they rested on a common base, and were united under one capital, which was embellished with delicately sculptured leaves of the palm tree or other foliage, and frequently ornaments were carried up between the shafts.

2d Gothic order.

In the second great change or order, the central and attached columns were worked up together in various combinations as to number; the capitals were not much ornamented, but each column had a distinct one, consisting partly of plain mouldings, and partly of delicate foliage running round it.

3d Gothic order.

Little change took place in the columns, during the third or florid style of Gothic architecture.

Windows.

The *windows*, during the prevalence of the Norman style, were narrow and rounded on the top; two or even three were sometimes placed together, and they usually had columns at the sides, and sometimes were placed between them as mullions.

1st Order.

During the first change from the Norman, the windows were long, narrow, and lancet-shaped, divided by one plain mullion, and at most two in the upper tier; they had frequently a trefoil lozenge, or some simple ornament between the tops, and had small marble shafts on each side, both externally and internally. There were sometimes two or three tiers or rows of these windows in the east and west ends, and not unfrequently three in a row.

2d Order.

In the second æra, reckoned that of the most perfect Gothic, the windows were made much larger; they were divided into several lights, by mullions which spread into tracery of leaves, flowers, quatrefoils, rosettes, &c. in the upper part. During the time of the two first, and part of the third Edward, pediments were formed, at first by means of mouldings in straight lines meeting in an acute angle at a considerable distance above the top of the window, having crockets up the back of the mouldings, which terminated in a rich knot of flowers, resembling the blossoms of the Euphorbium. By degrees the mouldings of the pediment were formed into an ogee sweep, and elegant pinnacles were raised on each side at the springing of the arch; after expanding to a great breadth, the window was again considerably contracted.

3d Order.

In the third, or florid style, the windows become more open, and were flatter at the top; their parts were so minute as to become only a sort of frame for the glass, divided by rectilinear transoms, frequently ornamented by an embattled fret.

The *Ornaments* may be comprehended under the terms

Ornaments. Norman.

mouldings and sculpture. In the Norman style the mouldings were chevron work, or zig zag moulding; embattled frette; triangular frette; nail head moulding; billet moulding; or cylinder cut into parts; fascia, band or fillet; hatched mouldings; nebuli terminated by an undulating line. Ranges of small arches upon small pillars or pilasters were also used for ornaments; they frequently intersected each other, and were sometimes placed upon corbels or brackets with carved heads. These latter ornaments were likewise found in the spandrel of arches or capitals, and above the keystones. Some whole figures are found over doors in mezzo relievo, being the nearest approach made by the Normans to a statue.

1st Order.

In the first change from the Norman, the mouldings were less various than in the Norman, and were usually composed of leaves or flowers, with which, not only arches of windows, but pillars, were decorated. Trefoils, quatrefoils, cinquefoils, roses, mullets, bosses, pateræ, &c. are found in the spandrels of arches and above keystones. Ornamented pinnacles are found upon shrines; also pediments in straight lines, extremely high, with niches and small statues under them; and on the west front, niches with statues as large as life.

2d Order.

In the second order, the ornaments are more various and graceful: as finer niches, tabernacles, and statues; pinnacles though not so lofty, yet more richly embellished with leaves, crockets, and other sculpture; also rich screens, stalls, and panneled ceiling.

3d Order.

During the third order, there is found a profusion of fret work, figures, niches, tabernacles with canopies, pedestals, crockets, tracery; but above all the rich pendents and finials, all of the most exquisite execution, and that equally in stone, wood, and brass.

General distribution of ecclesiastical structures.

The following description of the situation and distribution of a religious establishment, during the prevalence of Gothic architecture, will convey a pretty distinct idea of the general plan of ecclesiastical structures. It is taken from a well written account of the town of Shrewsbury, published in 1808. The principal buildings of an abbey, were, 1st, The church, which consisted of a nave or great western aisle, choir, transept, and usually a large chapel beyond the choir dedicated to the Blessed Virgin, with smaller chapels or chantries adjoining the side aisles of the choir, and sometimes of the nave. In short, an abbey church differed hardly at all from one of our cathedrals. Attached to one side of the nave, commonly the southern, was, 2dly, The great cloister, which had two entrances to the church, at the eastern and western ends of the aisle of the nave, for the greater solemnity of processions; and over the western side of the cloister was, in general, 3dly, The dormitory of the monks; a long room divided into separate cells, each containing a bed, with a mat, blanket, and rug, also a desk and stool, occupied by a monk. This apartment had a door which opened immediately into the church, on account of midnight offices. Attached to the side of the cloister, opposite to the church, was, 4thly, The refectory where the monks dined. In the center of the upper end, raised on two or three steps, was a large crucifix. On the right hand, at a table, sat the abbot, when he dined there: and, in his absence, the prior with his guests, of which there were every day many; and on the left the sub-prior. The monks sat at tables, ranged on each side of the hall, according to their offices and seniority. Near the refectory, under which were cellars, as at Worcester, &c. was, 5thly, The locutorium or parlour, an apartment answering to the common room of a college, where, in the intervals of prayer and study, the monks sat and conversed. This was the only room in which a constant fire was allowed in winter. Beyond was the kitchen and its offices, and adjoining to it, the buttery, lavatory, &c. On the eastern side of the cloisters, was, in the center, 6thly, The chapter-house, where the business of the abbey was transacted. On one side was a place with stone benches around it, where, perhaps, the tenants waited; on the other, a room in which records were deposited, and near it the library and scriptorium, where the monks employed themselves in copying books. On this side also, close up to the transept of the church, was the treasury, where the costly plate and church ornaments were kept. Beyond the greater cloister was frequently, in the greater abbeys, a smaller, perhaps for the lay brothers, as at Gloucester. And more eastward was the lodging of the abbot, consisting of a complete house, with hall, chapel, &c. The other principal offices of the convent had also separate houses, viz. the cellarer or house-steward, the sacrist, almoner, &c. as at Worcester. In this part was usually the hostery and guesten-hall, rooms for the entertainment of strangers; also the apartments for novices. Westward of the cloister was an outward court, round which was the monks infirmary, and the almery. An embattled gate house led to this court, which was the principal entrance of the abbey. The whole was surrounded with an high wall, generally fortified with battlements and towers. The precinct which it included, was, besides the above-mentioned buildings, occupied by gardens, stables, a mill, barns, granary, &c. Some of the great abbeys situated in the country, as at Glastonbury and Furness, covered sixty acres.

Pluscardine priory.

In the survey of the province of Moray, in Scotland, we have the following particulars respecting the priory of Pluscardine, situated six miles west of Elgin, which, in the distribution of its internal buildings, is said to be after the plan of the French priories and convents of that æra. It was surrounded by a stone wall about 15 feet high, inclosing an area of ten acres. The first edifice is the church, originally intended to have been built in the form of a cross.

Dimensions of Pluscardine Priory.

Dimensions.

	Feet.	In.
Length from north to south, (on the east has been a suit of aisles,)	94	4½
Breadth within the aisles, ...	27	8
Ditto including the aisles, ...	46	10
Length of the eastern transept, ...	56	1
Breadth of ditto, ...	26	4
Contiguous to the church, on the south is the Lady or Virgin's aisle, extending from east to west, ...	56	1
Breadth of ditto, ...	13	0
To the south of the Lady's aisle is the chapter-house supported by a clustered pillar, an elegant room, having four very large windows, it is . . . . (square,)	30	0
Contiguous to this, on the south, is a vaulted lobby, leading to a cloistered court on the west.		
Beyond this, to the south, is the kitchen, supported by two pillars; length	45	6
Breadth	29	8

Beneath the southmost half of the kitchen was

	Feet.	In.
a large vault, employed as a cemetery; the doors to it are still to be seen.		
Contiguous to, and at right angles with the kitchen, on the west, was the refectory, a large hall; length	94	0
Beneath this there was a range of cellars.		
On the west of the Lady's aisle and chapter-house, &c. was a cloistered court, for enjoying the benefit of the open air in rainy weather; its south wall was formed by the north wall of the refectory; length	99	8
Breadth	94	4
Along the roofs of the Lady's aisle, and chapter-house, and kitchen, was the dormitory; length	114	2
Breadth	29	8

It was divided by a passage in the middle into two suits of bedchambers, in number thirteen.

At the south-east corner of the kitchen stood the prior's house, communicating with the church by a door in the south-east corner of the dormitory, the passage in the middle of which led by another door to the church.

Immediately above the east gate of the gable of the Lady's aisle was a chamber, in which the prior usually spent the forenoon.

Contiguous to the north side of the transept, and communicating with it by a door, was the vestry, a vaulted building, ... (square) 16 0

The garden was well stored with fruit trees, and a stream was conducted within the boundary wall, and drove a corn mill.

This priory was founded in 1230, by king Alexander II. The monks were Cistercians.

After the very full discussion respecting the progress of the Norman and Gothic styles, which we have already introduced into the heads of History and Practice, we shall be very succinct in the following references to the engraved specimens, for which we are indebted to the pencil of Mr Blore.

PLATE CLXVI. Fig. 1.

Plate CLXVI. Fig. 1. Crypt at Minstre, in the Isle of Thanet. Mr Flaxman states, on the authority of one of our ancient historians, that there was a monastery at this place, which was destroyed by the Danes in the year 600, and which was never afterwards rebuilt. It is therefore probable, that this crypt (which now forms the cellar of a farm house) was part of this early monastery. The style is very simple, and might with propriety be referred to an early date, without this additional circumstance in its favour.

Fig. 2.

Fig. 2. West door of the church of Cliff near Dover. This is a specimen of the early Norman style. The pediment over the semicircular door is decorated with the billett moulding, an ornament peculiar to this style. The keystone of the outer semicircular arch consists of a rude representation of the Deity in the act of benediction, and on each side is an angel. Within is a narrow border of semicircular interlacing arches; next to which is the embattled fret, another ornament also peculiar to this style. The innermost moulding is decorated with a series of flowers, in the execution of which there is no variety.

PLATE CLXVII. Fig. 1.

Plate CLXVII. Fig. 1. South entrance to the church of Jedburgh in Roxburghshire. The monastery of Jedburgh was founded by David I., consequently its age can be nearly ascertained. The north entrance is the latest Norman style. On the outside is the zig-zag, or chevron ornament, the most common of all the decorations used by the Normans. Next to this is a moulding, covered with a series of grotesque figures and flowers. The capitals of the columns are finished with foliage, and the columns themselves clustered.

Fig. 2.

Fig. 2. North front of the Abbey of Kelso, in Roxburghshire, also built by David I. In this, is an example of the interlacing of the circular arches, and in the large arch is a succession of mouldings well executed.

PLATE CLXVIII. Fig. 1.

Plate CLXVIII. Fig. 1. Arches from the Treasury, Canterbury. The capitals in this specimen are all varied, which is usually the case in all Norman works. Over each capital is an ornament, evidently copied from Roman remains. This an elegant specimen of the decorated Norman.

Fig 2.

Fig. 2. An arch from the tower of St Augustine's monastery, Canterbury, built immediately after the Conquest.

Fig. 3.

Fig. 3. An early specimen of the Catherine Wheel window, from the east end of Barfreston church, Kent. The whole of the east end of this church is in the latest Norman style, and highly decorated. The series of grotesque figures that surround the window are highly characteristic of the style.

Figs. 4, 5, 6, 7.

Figs. 4, 5, 6, 7. Specimens of ornamented columns from the tower of St Augustine's monastery, Canterbury.

Figs. 8, 9, 10.

Figs. 8, 9, 10. Norman capitals, the first from the tower of St Augustine, and the two last from the crypt under the cathedral, Canterbury. The last resembles very strongly an Egyptian capital which we have given from Denon, in Plate CL.

Figs. 11, 12.

Figs. 11, 12. Ornamental borders from Barfreston.

PLATE CLXIX.

Plate CLXIX. contains a view of the west front of Holyrood Chapel, Edinburgh, with the details of that period.

Holyrood House.

The Abbey of Holyrood House was founded and nobly endowed by King David I. in 1128. It suffered considerably when the English burned the palace in 1544, but it was soon after thoroughly repaired. Before the Restoration, it had been used as the parish church of the Canongate; but when the palace was repaired by King Charles, the chapel was fitted up in a very elegant manner, and was set apart as a chapel royal in all time coming. A throne was raised for the sovereign, and twelve stalls for the knights of the thistle, and a handsome organ was erected. As the roof of the chapel was in a ruinous condition, it was found necessary to repair it; but an injudicious architect who was employed, covered it with a new roof of flagstones, which the walls had not sufficient strength to support. Another architect reported in 1766, that the chapel would fall unless the new roof was taken off, and his prediction was verified on the 2d December 1768. The building is now completely in ruins, and the mullions of the fine Gothic window at the east end of the chapel are completely destroyed.

PLATE CLXX.

Plate CLXX. contains a representation of the outside and inside of Melrose Abbey.

Melrose Abbey.

The present abbey of Melrose, which stands on the south side of the Tweed, is justly reckoned one of the most magnificent in the kingdom, both from the height and embellishment of the columns, from the beauty of its sculptures, and the general symmetry of its parts. It was founded in 1136 by King David, endowed with large revenues and extensive privileges, and dedicated to the Virgin Mary.

"The church," says Mr Thomson, "is built in the form of St John's cross. The chancel, which is a very stately fabric, is still standing; its roof is very curious, and has much of the scripture history upon it. I have taken the measure of what is standing of this church, although much of the west part is so entirely demolished, that we cannot know how far it has reached in that direction. Its just length is 258 feet; breadth 137½; circumference about 943; height of the south window 24, breadth 16; height of the east window 34½, breadth 15½; height of the steeple 75; the spire gone. The east window, at which was the great altar, is a beautiful structure; consisting of four pillars or bars, with a great deal of curious work between them; and on each side, a great number of niches for statues. On the top, an old man with a globe in his left hand, resting on his knee, and a young man on his right; both in a sitting posture, with an open crown over their heads. On the north and south of this window, are two others of smaller dimensions. The niches are curiously carved, both the pedestals and canopies, and on which several figures of men and animals are curiously cut. On the south-east of this church are a great many musicians admirably cut, with much pleasantness and gaiety in their countenances, accompanied with their various instruments. Also nuns with their veils; some of whom are richly dressed. The south window is very much admired for its height and curious workmanship: Niches are on each side and above it, where have been statues of our Saviour and the apostles. Besides, there are many other figures on the east, or on the west side of this window: Monks curiously cut, with their beards, cowls, and beads: A cripple on the back of a blind man: Several animals cut very nicely, as boars, greyhounds, lions, monkies, and others. There are about 68 niches in whole standing: the statues were only demolished about the 1649.

So far with respect to the outside of the church. Within, on the north side of the cross, are beautiful pillars, and the sculpture as fresh as if it had been newly cut. On the west side is a statue of St Peter with a book open, his right hand on it, and two keys hanging on the left. On the south side of this statue, is that of St Paul with a sword. In the middle of the cross stood the steeple, a piece of noble architecture, a quarter of it yet standing, but the spire gone. The roof of the south side of the cross is still standing, where is a beautiful staircase, much admired by strangers, the roof of it winding like a snail cap. There was within the church a vast number of fonts curiously carved, and where were altars dedicated to various saints. In the portion of the church where worship is at present performed, are two rows of pillars of excellent workmanship, especially that to the south east, which, for the fineness of it, looks like Flander's lace.

With regard lastly, to what was in part, or altogether, separated from the body of the church, there was a cloyster on the north side, a part of the walls of which is still remaining; and where may be observed pleasant walks and seats, with a great deal of fine flowers nicely cut, as lilies, &c. also ferns, grapes, house-leeks, escalops, fir-cones, &c. The door at the north entry of the church is curiously embossed, and the foliage here, and in several places of the church, very beautiful. There were also here a vast many fine buildings within the convent, for the residence and service of the abbot and monks, with gardens and other conveniences; all this inclosed within a high wall, about a mile in circuit. Besides the high church, there has been a large fine chapel, where the manse now is, and another house adjoining to it, where the foundations of the pillars are still to be seen. On the north side of this house there has been a curious oratory or private chapel, the foundations of which have been discovered this year, and a large cistern of one stone, with a leaden pipe conveying the water to it." See the account of Melrose in the *Statistical Account of Scotland*, vol. ix. p. 89, by the Rev. Mr Thomson.

Plate CLXXI.

Plate CLXXI. contains a representation of one of the turrets of Henry VIIth's Chapel, and of a pendent from the cathedral church at Ely.

Private dwellings.

Ashridge.

Plate CXCI.

Hitherto we have considered Gothic architecture only in religious structures, but of late years, it has sometimes singly, but more frequently combined with castellated features, been employed in the decorations of private dwellings, viz. of the Earl of Bridgewater in Hertfordshire, the Earl of Moira in Leicestershire, the Earl of Grosvenor in Cheshire, and the Earl of Lonsdale in Westmoreland, all extensive and splendid mansions. With the permission of the noble owner, and aided by the able architect Mr Wyatt, we have selected specimens from the first of these edifices. We were induced to fix upon this, from its being constructed under the direction of a man of acknowledged fine taste, whose genius was left at free scope by a liberal and wealthy employer, and from its being situated within the reach of architectural students connected with the metropolis. In Plate CXCI. we have given the whole plan of the principal floor, in order to shew the relative situation of the parts, selected as specimens of Gothic decoration, and because the distribution, shape, and dimensions of the public apartments, are highly deserving of attention; nor is the merit less in the arrangement of the offices, which comprehend every conveniency in its proper form and place. The name and dimensions of each apartment being marked on the plan, the whole will be evident from inspection.

In the same Plate is given that part of the north front which is included between A and B on the plan. This, and a part of the south front from C to D on the plan, sufficiently shew the variety of manners in which the architect has managed the external façades. Our limits do not permit us to give a drawing of the chapel, which, both externally and internally, is of elegant and highly decorated Gothic, of the middle and latter styles. As it is professedly of rich cathedral architecture, it is on this account less appropriate to our present purpose, which is to treat of private dwellings.

Plate CXCII.

With regard to interior decoration, we have in Plate CXCII. given a section of the hall and principal staircase, from which it will be seen, that, in these apartments, the effects of the ornamental bracketted Norman roofing, richly canopied niches, with the numerous pannellings, small pillars, and pointed arches, are perhaps even more striking, than any application of Greek or Roman architecture. Similar observations will apply to the conservatory, in which the superiority of the Gothic is, if possible, still more evident.

We shall now conclude this branch of our subject, by giving a brief detail of the ingenious theory of Gothic architecture by Sir James Hall, Bart. which has already been noticed under the History of Architecture.

Sir James Hall's theory of Gothic architecture.

In Sir James Hall's theory, it is conceived, that the forms of Gothic architecture may have been derived from the imitation of a rustic dwelling constructed

Plate CLXXII. Fig. 1. Fig. 4.

as follows. Two rows of posts are thrust into the ground opposite to each other, the intervals between the posts of the same row being equal, and each post rising to the height of about three of those intervals, as shewn in the ground plan, Plate CLXXII. Fig. 1, and in the view, Fig. 4.

Elements of arcades. Fig. 2. Fig. 5. Fig. 2.

A set of slender rods of willow are then applied to the inside of each post, and thrust into the ground along with it. These rods being rather longer than the posts, they are bound together by two tyings, one near the ground, and the other about two-thirds of its height. The rods from that last binding upwards being entirely loose, and free to be moved in every direction. Fig. 2, shews the ground plan of this arrangement; and Fig. 5 one of the posts, with its rods applied, and as seen in front between the rows. In this simplest case, the number of rods applied to each middle post is 5, and 3 to each end post, as shewn in the ground plan, Fig. 2.

Fig. 3. Fig. 6. Fig. 8. Fig. 9. Fig. 7. Fig. 10.

The loose summits of the rods are then brought to meet, and are bound together, so as to form the frame work of a roof fit to bear the thatch, as shewn completed in the ground plan, Fig. 3; but in order to render the construction intelligible, the three different forms of which it is composed had better be considered separately. First, Two loose summits are made to meet from each pair of opposite posts, crossing each other in the middle, and producing the form of the Gothic pointed arch, a view of which is shewn in Fig. 6, the same being represented, or as executed with every such pair of opposite posts in the ground plan, Fig. 8. An horizontal rod or pole (which in this system is called the ridge-bar) is then laid upon the forks of the crossing rods, and bound to each of them, thus producing a continued Gothic arcade. Next two loose summits are made to meet from every neighbouring pair of posts in the same row, a set of arches similar to those first mentioned being thus produced, and standing opposite to each other in pairs, as shewn in Fig. 9, each pair of opposite arches being connected by a transverse ridge-bar laid upon the forks. Two loose summits now remain to be employed in each post. These are made to meet diagonally from the opposite corners of each rectangle; but in meeting, they are not made to cross as in the two cases last mentioned, but are applied side by side, so as to form a continued curve or semicircle, and are joined together after the manner of a hoop, as shewn in Fig. 7. These diagonal arches cross each other at the centre, as shown in Fig. 10, and at their crossing touch the underside of the ridge-bar.

Fig. 3. Fig. 11. Fig. 12.

These various forms will all be found combined in the ground plan, Fig. 3, and in the view, Fig. 11, seen as looking along from within. Fig. 12 shews a stone building of the Gothic style, in which all the same forms may easily be traced.

Elements of windows. Fig. 13. Fig. 14.

The mullions of the Gothic windows, seem to have arisen from the imitation of open ribs of cage-work. The simplest form is obtained, as shewn in Fig. 13, by a set of upright rods placed at equal intervals, split down to the level of the impost, one half of each rod being carried to the right, and the other half to the left, each forming an arch similar to a portion of the main arch, which it meets, and then by their crossing, producing a set of forms at once varied and symmetrical. Another design has been obtained, by splitting the rods, as in the last case, then bringing each half rod to meet with a similar half in the middle between each neighbouring pair of uprights, these halves at their meeting not being made to cross, but being bound back to back, and then drawn asunder, so as again to meet their own halves, to which they are bound, and so on till the space is filled, as shewn in Fig. 14, with a set of waving forms all perfectly equal and similar.

Figs. 15, 16.

These two last forms are represented as executed in stone work in Figs. 15 and 16.

In this manner, the rudiments of the Gothic style are pointed out by Sir James Hall in his memoir, read in the Royal Society of Edinburgh April 7, 1797.

The same gentleman has undertaken, in a work now in the press, to vindicate the authenticity of the principle here announced, by its application to the boundless diversity of forms employed in Gothic architecture, both as to roofs and windows, constructed according to devices similar to those just stated, and as affording an explanation of the other departments of the style equally diversified, as the door, steeple, pinnacle, border, &c. To this work the reader must be referred for more perfect information, which we have reason to expect it is well calculated to afford, having long occupied the unwearied research of the author, and being, we understand, illustrated by 58 beautiful engravings executed by Mr Blore.

If this system has really guided the Gothic architect, it seems strange, that the fact should not have been recorded in history; but Sir James Hall also undertakes to account for that silence in a satisfactory manner.

The following table of well established facts, translated from the work of a French author, Rondelet, being selected both from the Roman and Gothic schools, cannot fail of being acceptable to the young architect.

Table *shewing the ratio of the walls, and points of support of several Edifices, to the total superficies which they cover.*

Names of the Edifices.	Total superficies in		Superficies of the points of support in		Ratio in thousandths of the total superficies.
	Metres.	Toises.	Metres.	Toises.	
The Pantheon at Rome,	3182.0	$837\frac{7}{18}$	739.2	$194\frac{1}{4}$	0.232
Temple of Peace at Rome,	6238.2	$1665\frac{1}{7}$	796.7	$209\frac{2}{3}$	0.125
Great Temple at Pæstum,	1426.9	$375\frac{1}{2}$	246.2	$64\frac{3}{4}$	0.172
Ancient Temple, called Galluzo, at Rome,	855.6	$225\frac{1}{6}$	201.4	53.0	0.226
Temple of Concord at Girgenti, in Sicily,	636.6	$167\frac{1}{2}$	123.6	$32\frac{1}{2}$	0.194
Temple of Juno Lucina at Girgenti,	634.0	$166\frac{3}{4}$	103.2	$27\frac{1}{6}$	0.163
Building in the middle of the baths of Caracalla,	25604.4	6798.0	4499.2	1184.0	0.176
Ditto ditto Dioclesian,	32680.0	8600.0	5464.4	1438.0	0.167
Church of St Stephen le Rond at Rome,	3413.2	$898\frac{2}{9}$	190.6	$50\frac{1}{6}$	0.056
Ditto St Sophia at Constantinople,	9591.1	2524.0	2097.3	552.0	0.217
Ditto St Paul without the walls of Rome,	9899.0	2605.0	1176.1	$309\frac{1}{2}$	0.112
Ditto St Mary-des-fleurs at Florence,	7881.2	2074.0	1582.7	$416\frac{1}{2}$	0.201
Ditto Cathedral at Milan,	11696.4	3078.0	1985.6	$522\frac{1}{4}$	0.161
Ditto St Peter at Rome,	21103.1	$5553\frac{4}{9}$	5511.9	$1450\frac{1}{2}$	0.261
Ditto St Vital at Ravenna,	676.2	178.0	106.1	28.0	0.157
Ditto St Peter-aux-Lions at Rome,	2000.0	$529\frac{2}{3}$	311.6	82.0	0.155
Ditto St Sabine at Rome,	1407.0	$378\frac{1}{4}$	143.4	$37\frac{3}{4}$	0.100
Ditto St Dominique at Palermo,	3173.2	$835\frac{1}{18}$	463.6	122.0	0.146
Ditto St Joseph ditto,	2420.6	637.0	335.6	88.0	0.139
Ditto St Philip de Neri at Naples,	2121.4	$558\frac{1}{4}$	273.6	72.0	0.129
Ditto St Paul at London,	7809.0	2055.0	1330.0	350.0	0.170
Ditto Notre Dame at Paris,	6258.6	1647.0	816.4	$230\frac{2}{3}$	0.140
The House of the Invalids at Paris,	2695.4	$709\frac{1}{2}$	724.0	$190\frac{1}{2}$	0.268
French Pantheon,	5593.6	1472.0	861.4	$226\frac{3}{4}$	0.154
Church of St Sulpice,	5646.8	1486.0	848.2	$223\frac{1}{5}$	0.151

N. B. A Metre is equal to 39.371 English inches, and a Toise equal to 76.726 English inches.

Conclusion.

Conclusion.

Having discussed the history and practice of the various schools of architecture, and also endeavoured to develope the general principles on which the art is founded, we shall conclude the subject with a few general remarks.

Egyptian.

The ancient Egyptian architecture, from the simplicity of its outlines, and the locality of the subject of all its sculptures, appears to have a strong claim to originality.—That the works, in which it was displayed, were the offspring of superstition and despotism, is undeniable; that the surface of their edifices were the records of religious rites, astronomical knowledge, operations during war and peace, is likewise most evident; but their modes of sculpture having been distinctly defined, and stamped with a religious character, each effort became the act of a monastic community, and proved an effectual bar to any improvement arising from individual experience and competition. Although the remains of this school have, as historical monuments, deservedly enjoyed the admiration of mankind, yet being entirely local, and having been formed under circumstances not likely again to occur, few practical advantages can ever result from the study of its principles or practice. The experiment lately made in the front to the Museum in the street of Piccadily, in London, is a proof how unfit it is for private dwellings, or indeed for any purpose in these times, excepting perhaps a mausoleum.

Mode of moving large masses.

The removing and arranging large blocks of stone, of which many of the edifices were composed, has been adduced as an evidence of the great progress made by the Egyptians in practical mechanics; but as all their operations bespeak rather the patient application of labour than the efforts of genius, it is reasonable to conclude that the whole was accomplished by very simple means. The quarries being situated on the banks of the river Nile, enabled them, during its increase, to raise and remove, as far as its branches and canals extended, the largest blocks of stone which were required. The edifices being generally adjacent to the water, these blocks could be moved from the shore by means of strong frames, drawn as sledges, or upon rollers, and then raised into the situations for which they were destined, upon inclined planes of earth, which were afterwards removed.

India.

The religious edifices of India seem to have been constructed under circumstances somewhat similar to those in Upper Egypt, and, in respect to them, similar observations are applicable: They are, therefore, to the western world, also, more the subject of historical discussion than practical imitation. The utmost splendour we can trace in the descriptions of their ancient palaces, or those of the most enlightened of their Mahometan invaders, arose from the use of silks, feathers, and a profusion of gold, silver, and precious stones. These latter remarks are equally correct with regard to Persia, if we except Persepolis, and the works of the Greek and Roman invaders. With regard to Persepolis, we have formerly observed, that, from the slender proportions of the columns, it is probable their covering was slight; that the elementary parts of their capitals and bases, though partly Egyptian, might have been suggested partly by the rich silks, precious stones, and other decorations occasionally attached to the tops and bottoms of slender posts. Throughout Persia, in latter times, the use of Gothic arches, and Turkish domes, highly ornamented, have

Persia.

Conclusion.

been extensively introduced in their palaces, mosques, and tombs. The hand of the Mussulman has likewise reached the remotest quarters of India.

China.

In China, it is the repetition of tent architecture alone which is every where to be found; and, equally in the pagoda and palace, some additional japanning and gilding exhausts the limited resources prescribed by their mischievous legal regulations.

General observations.

From the eastward of the Euphrates and the Caspian, the architects of the West can, therefore, only glean some information respecting silks, feathers, gilding, japanning, and the slight, though sometimes elegant, forms of tent architecture; yet, even from this slender stock of materials, the man of genius will derive useful aids in the practice of his art.

Greece.

Three orders.

Specimens.

Columns should be large.

It was in the small and rugged country of Greece, that the arts, as well as the philosophy of Africa and Asia, were collected, refined, and exalted. Here architecture and sculpture, instead of deriving dignity, as formerly, from their magnitude, or from the mere application of an immense quantity of labour, became the subjects of original genius and keen competition: The ambition of surpassing each other in excellence, appears to have inspired not only individual artists, but whole states. Thus, from a few imperfect hints, probably imported into Greece, a totally distinct school was established, which has become the canon of the western world. The three Greek orders form a perfect gradation of character, and when preserved of due magnitude, and properly applied, never fail to command admiration; their friezes and pediments afford instances of the richest decoration that sculpture could supply; this was generally historical or allegorical, and composed of human, or other animal figures, of the most exquiste design and workmanship; it was only in the capitals of their columns, and the subordinate members of their entablatures, they introduced vegetable forms, and these were distributed with a peculiar delicacy. Our specimens of Greek architecture having been all procured from public buildings, seldom wholly covered on the top; we have, therefore, little knowledge of their mode of decorating ceilings; we know that the porches and walls of some of their temples were painted with historical subjects by their most eminent artists. Of the decoration of their doors and windows, little is known, and it does not appear they had any ballustrades. In their finest temples they worked with rich marbles; but the essential members of their orders represented the parts of a wooden edifice. In pursuing the practice of this school, the artist will find a sufficient variety in the specimens collected and published by Athenian Stuart, and in the Ionian Antiquities; and his own genius will have sufficient exercise in making a judicious selection, and in preserving the true spirit of the original, when adapted to local situations and purposes; and although our limits prevent us from pursuing this part of the subject further, yet we cannot quit it without remarking, that one of its finest members, a column, will seldom have much dignity unless of considerable magnitude, and therefore can only be introduced with success in edifices of more than usual consideration.

Roman school.

In the Roman school, the profusion of decoration which distinguished it, can only be considered as an injudicious extension of the Greek manner; and it has been remarked, that in their decorations they had more recourse to imitations of vegetables: But the distinguishing characteristic of Roman architecture was the circular forms, which, it seems probable, they originally derived from the Tuscans. The use of arches enabled them to cover spaces even larger than those formerly left open by the Greeks; this produced the beautiful temples of the Pantheon and of Vesta; by this means they were enabled to construct domes, and all the varieties of enriched soffits which furnished models for the most superb of our modern ceilings. They generally derived dignity from the magnitude of their orders, but they diminished it by placing them upon pedestals, instead of upon simple platforms in the manner of the Greeks. When to the beforementioned advantages, we have, in some future articles, an opportunity of adding their magnificent aqueducts and triumphal arches, it will be seen that a new and noble field was, by this people, opened to the architect and engineer.

Gothic.

In Gothic architecture, the ground plans were modelled indiscriminately upon the oblong platform of the Egyptians and Greeks, and the square and circular forms of the Roman school; but the universal application of groin arching, with the employment of materials of small dimensions, and a disposition to increase in comparative elevation, created a school very different from any that preceded it. The various modes which were from time to time adopted, to produce extraordinary effects, at last reduced the masonry of the edifice to the nature of a slender framing, and not unfrequently, in some parts, to resemble films of lace or filigree work. And although the minuteness of parts and profusion of decoration in the latter Gothic have exceeded the bounds of correct taste, yet even in these, and in every stage of this school, the discerning architect will find much to admire and to imitate: amidst such variety, he will be at no loss to select features suitable to most situations and circumstances, from the perfectly simple to the most highly embellished character.

General reflections.

In surveying each of the schools of architecture which have prevailed in the western world, it will be evident that the progress has hitherto uniformly been from massive plainness to an extreme of delicacy and a profusion of decoration. We hope that an attention to the general principles, here pointed out, may, in future, prove the means of preserving architecture from these blameable extremes.

Parts to be treated separately.

We are aware that the desire of rendering this article perfect, has extended it to an uncommon length, and yet we are conscious that many branches of this important art will still appear to have been almost overlooked; this renders it necessary for us to state, that having discussed the subject generally, it is our intention occasionally, during the progress of the work, to treat some of the particular parts at greater length, under their proper heads. See particularly MASONRY.

The following is a list of the writers upon architecture, who have been referred to in this article:

EGYPTIAN.—Pococke, Norden, Greaves, Volney, Granger, Savary, Denon, and French Commission of Arts.

INDIAN.—Robertson's Ancient India, Sir William Jones, Asiatic Researches, Maurice on Indian Antiquities, Grose, Daniel, Hodges, Col. Syme's Embassy.

PERSIAN.—Sir John Chardin, C. Le Brun, Macdonald Kinneir.

CHINESE.—Duhalde, Sir William Chambers, Le Compte, Lord Macartney's Embassy, Barrow's Travels.

GREEK.—Homer, Pausanias, Diod. Sicul., Strabo, Vitruvius, and from the latter author, we learn that Silenus wrote upon Doric symmetry; Theodorus, and on the Doric temple of Juno at Samos; Ctesiphon and Metagenes upon the Ionic temple of Diana at Ephesus; Philios or Pythius upon the Ionic temple of Minerva at

Conclusion.

Priene; Ictinus and Carpion upon the Doric temple of Minerva in the citadel at Athens; Philo upon the symmetry of sacred edifices; Hermogenes upon the pseudodipteral temple of Diana at Magnesia, and the monopteral temple of Bacchus at Teos; Argelius upon Corinthian symmetry, and the Ionic temple of Æsculapius at Tralles; also Nexaris, Theocydes, Demophiles, Pollio, Leonides, Selalanion, Melampus, Sarnacus, and Uphrana, wrote upon symmetry. Amongst the moderns, Pococke, Wheeler, and Spon, Chandler, Le Choiseul, Stuart, Willey Reveley, Revet, and Pars, have written respecting Greek edifices; and much information is also to be derived from the travels of Anacharsis. Of the ancient Romans, both the Plinys are good authorities; but Vitruvius is the only author professedly on the subject, whose works have reached modern times; and he only mentions two others who had preceded him, that is to say, Terentius Varro, who wrote one book, and Publius Septimus, who wrote two books upon architecture.

Since the revival of Roman architecture, the writers upon the art have been numerous, but the principal are the following:

Italians.—Leon Battista Alberti, Sebastian Serlio, Giacomo Barozzi, usually named Vignola, Andrea Palladio, Vincenzo Scammozzi, Piranesi. See particularly Eustace's *Classical Tour through Italy*. Lond. 1813.

French.—Philibert de Lorme, Blondel, Claude Perrault, Desgodetz, J. Rondelet.

British.—Sir Henry Wotton, Inigo Jones, Lord Burlington, Ware, Wren, Gibbs, Aldrich, Price, Chambers, Adam, Stuart; the Vitruvius Britannicus, begun by Campbell, carried on by Gandon, and lately continued to the present time, by G. Richardson. Although it does not fall within our plan to notice the numerous books of architectural designs, which have of late years made their appearance, we must not omit drawing the attention of the student to the valuable works of Mr Peter Nicholson, who has successfully applied the principles of geometry to the elementary parts of architecture, and shewn in what manner this art ought to be regulated by correct science. The writer of this article also here embraces the opportunity of acknowledging that gentleman's aid in what regards this part of the subject.

Gothic architecture has of late been ably investigated by Wharton, Grose, Bentham, Dallaway, Milner, Whittington, Britton, Carter, Dawkins, Sir James Hall, the Rev. J. C. Eustace, Mr Hawkins, Mr Haggit, and in various papers in the Archæologia.

For distinct and philosophical information respecting the principles of architecture, the reader is referred to Messrs Stewart, Alison, Gerard, and Knight, who have each written upon the subject of taste. (γ)

Civil law.

CIVIL LAW

CIVIL LAW, in a general sense, denotes the law of any particular state, more commonly called its municipal law; but, in a restricted and more usual sense, it signifies the legal institutions of ancient Rome, which are called by way of eminence *the* civil law.

The Roman laws, proceeding from a variety of sources, had, like the institutions of any other country which has for a considerable time been advancing in civilization, accumulated to a very great and inconvenient extent, when, in 438, Theodosius the younger, then emperor of the West, ordered a digest to be made; which, however, without exploring the other sources of the law, was confined to the institutions promulgated by the emperors, and then in force in his part of the empire. This *Theodosian code* was the first attempt at a methodical collection of the Roman jurisprudence, which had the sanction of public authority,—for several digests had been previously made by private lawyers, to facilitate the study and practical application of the law. But the most celebrated collection was that made about the year 533 at the command of Justinian, then emperor of the eastern empire. This collection, though posterior in time, did not supersede the authority of Theodosius's code, each being framed for the respective divisions of the empire over which these two emperors presided. So great, however, was the superiority of Justinian's collection, that, upon the dissolution of the empire, it came gradually to be adopted, more or less, even by those states of which the western division had been composed, and now forms part of the institutions of most of the modern states of Europe.

This celebrated collection consists, 1st, Of the *Institutes*, or elements of the Roman jurisprudence, intended as the rudiments of its study. 2d, Of the *Digests* or *Pandects* (πανδεκται) in 50 books, being selections from the writings of eminent lawyers systematically arranged. 3d, Of the *Code*, or a collection of the constitutions of the emperors in 12 books, brought down to a later period than the Theodosian code. And 4th, Of the *Novels*, or the *new* constitutions which had been promulgated from time to time by Justinian himself, the *Code* comprising only those of his predecessors. These different parts form together the body of Roman law known under the title of the *Corpus Juris Civilis*; the dicta of which, particularly of the institutes and pandects, being for the most part grounded in the true principles of a comprehensive utility, according with the moral sentiments of mankind, and expressed with great purity and elegance, have always been held in the highest estimation.

The revival of the Roman law in Europe, is commonly ascribed to the accidental discovery of a copy of the digests at Amalfi in Italy, about the year 1130. It is much more probable, however, that it emerged gradually into notice, not by any single accident of this kind, but with the gradual return of civilization which followed the long interval of barbarity, occasioned by the decline and final overthrow of the Roman greatness. Certain it is, that Justinian's collection, or the more valuable parts of it, whatever there may be in the fact of the discovery at Amalfi, were known and taught in some of the ecclesiastical seminaries in different quarters of Europe before that period.

The countries on the continent in which this system of jurisprudence has most authority, are Germany and Holland, where, unless when controuled by local customs, it forms the great body of their common law. In England it is received, under certain restrictions, in four species of courts, 1st, The courts of the archbishops and bishops and their derivative officers, usually called courts Christian, *curiæ Christianitatis*, or the ecclesiastical courts. 2d, The military courts. 3d, The courts of admiralty. And 4th, the courts of the two universities. In all these courts the authority of this law, and the different extent to which in different courts it may be pleaded, is grounded not on any authority in the law itself, but entirely on the custom or common law of the realm, corroborated as to the universities by act of parliament. In Scotland, its authority, where not contradicted by positive institutions, has been held by some lawyers as tantamount to the common law, and as, indeed, forming a part of it. That its authority, however, was at no time recognised to so great an extent, seems the more correct opinion; and it is certain that for at least a century, it has been recognised no farther than as supported by the express dicta, or analogies, of the decisions of the supreme court. Where these are silent, it may always, when not opposed by established custom or positive enactment, be pleaded as argument of grave consideration, but not as possessing any inherent and controuling authority. (s b.)

CIVITA-VECCHIA, the *Centum Cellæ* of the ancients, a seaport town of Italy, situated on a bay of the Mediterranean, on the arrondissement of Viterbo, and the department of Rome. It has a good harbour and arsenal, and was formerly the station of the pope's galleys. Not far from the town are the *Bagni dé Palazzi*, which are hot baths, known to the ancients under the name of *Aquæ Tauri*. There is also here a grotto from which sulphureous steam issues. About six miles from Civita Vecchia are the ruins of Leopolis, a town built by Pope Leo IV. in A. D. 854, and peopled with the inhabitants of *Centum Cellæ*.

Civita-Vecchia has always been considered as next to Ancona in maritime importance; and though the harbour is not capable of receiving large ships, it is frequented by numerous small vessels, which carry on a very extensive trade. The principal manufactures of this place, are those of leather, pottery ware, and linen and cotton cloths. Civita-Vecchia receives all the colonial goods which are consumed in the country, and carries on a considerable export and import trade. The principal exports are burnt sulphur, alum from Rome, grain, oils, wool, timber, salted anchovies, cheese, volcanic and red sand, which is used in making cement for building under water. The wood which is exported is principally staves of oak and chesnut, which are sent to Agde, Cette and Barcelona, and the alum was generally sent to Venice, France, and Holland. The imports are French wines, woollen and linen cloths, silks, salted fish, citrons, oranges, dry fruits, lint, soaps, and spices. Population in 1811, 9000 East Long. 11° 44′ 45″, and North Lat. 42° 5′ 24″. (w)

CLACKMANNAN, the county town of Clackmannanshire, is situated upon a bold swelling ground on the north side of the river Forth, about 22 miles above Leith. The name signifies the kirk town or village of Annan, from a connection formed in the 12th century betwixt the families of Bruce, and Annand of Annandale. The town is small and irregular: The buildings are humble, many of them going to decay, and are chiefly occupied by labourers, there being no manufactories of any kind carried on in it, excepting a few looms connected with Glasgow. Here the sheriff used to hold his courts, but the town-house and prison are in ruins, so that the courts are held at Alloa, except on particular occasions. At the west end of the town, and upon the brow of the hill, is situated Clackmannan tower, built prior to the year 1315, which was for a long period of years the favourite seat of the chief of the Bruces, who was hereditary sheriff of the county before the jurisdictions were abolished. The tower is rectangular, about 80 feet high; and from its elevated situation, forms a very picturesque, venerable, and strong feature in the surrounding scenery. Till lately there was a mansion-house of more modern date adjoining, in which a descendant of the line of Bruce lived, and who kept the sword and casque of the celebrated King Robert Bruce. These were bequeathed, with the genealogical tree of the family, to the Earl of Elgin, as representative of the family, in whose possession they are now to be seen. The view from the tower is esteemed amongst the finest in Scotland; the leading features of a beautiful landscape being there displayed in the happiest combination. From it the mazy course of the river Forth can be traced to a great distance, flowing through fertile fields, adorned with woods, cottages, towns, and vessels, while the horizon is formed by bold mountainous scenery, which, gradually receding from the view, blends with the western sky.

The population of the parish is estimated at 2800 souls, of whom 700 live in the town. N. Lat. 56° 15′, W. Long. 3° 40′. (r. d.)

CLACKMANNANSHIRE, a county in Scotland, situated on the north bank of the river Forth, bounded on the north by Perthshire, on the south by the river Forth, on the west by Perth and Stirling shires, and on the east by Fife and Perth shires; is about 10 miles in length, and 9 miles in breadth. It is one of the smallest counties in Scotland, and only returns a member to parliament alternately with Kinross-shire. It is divided into five parishes, viz. Clackmannan, Alloa, Tillycoultry, Dollar, and Logie; a part of the latter only is in this county.

As to its general aspect, the northern part is composed of that beautiful and picturesque range of mountains named the Ochills, which stretch in an east and west direction. They produce excellent sheep pasture. The western parts being rocky, are pastured by goats, on which account many persons in delicate health resort to Blair Logie in summer for the benefit of the goat milk. This spot has been denominated the *Montpellier* of Scotland; but the accommodation as to lodgings is very poor and humble indeed. The ground betwixt the Ochills and the sea is hill and dale, fit for the purposes of agriculture, with rich alluvial land on the banks of the Forth, termed carse ground. Besides the Forth, which bounds the county on the south, there are two rivers which flow through it, viz. the Devon, and Black Devon; these empty themselves into the Forth. The carse or alluvial land upon the banks of the Forth is very strong clay soil, and but little elevated above the level of the sea. The soil which immediately joins the carse upon the north is termed dryfield, and is of sandy loam, mixed with small stones. The hill and dale commences with the dryfield, and continues to the bottom of the Ochill mountains. The dryfield soil next the carse generally rests on a sandy bottom; but the greater part of the soil of the swelling grounds rests upon a strong tenacious red clay, mixed with sand and gravel, is quite impervious to water, and is denominated red till. The carse or alluvial land is of the best quality, producing luxuriant crops, and comparatively requires but little manure. The dryfield soil, which rests on a sandy bottom, is not inferior to the carse in point of produce; but the soil which rests upon the red clay is in value very inferior to any of the former, and requires much manure to keep it in good order for crops. In winter, it is liable to be excessively wet, as the subsoil will not absorb any of the superabundant moisture. The lower parts of the valleys are generally composed of a strong clay soil, but very different from the carse land. Upon the sides of the Devon, the soil is of a deep sandy loam, which bears good crops, and is termed haugh ground. There are a few inconsiderable patches of moss in the county where the lands are in cultivation; it however abounds upon the summit of the Ochills, which is much elevated above the level of the sea. The improvements in agriculture have been carried on here with great spirit. This county was amongst the first in Scotland where a farmer's club was instituted, patronized by the county gentlemen, with the present Lord Cathcart at their head. The first thrashing mill in Scotland was erected by the celebrated Mr Meikle in 1787, at Kilbagie, in the parish of Clackmannan; and this kind of machine is now to be found at almost every farm within the county. Attention has been paid in embanking considerable extents of land from the flowings of the sea, which have amply repaid the adventure. Lime is much used for land all over the county, though it costs very high, as the chief supply of it is either brought from Lord Elgin's works in Fife, or from the lime quarries in the vicinity of Dunbar.

Embanking.

Rivers.

River Forth.

With respect to rivers, the Forth, which flows upon the south side of the county, is navigable for ships of 500 tons as far up as Alloa; sloops of 60 tons can navigate to Stirling. The tides rise from 16 to 22 feet, and have the phenomena of double tides. (See the article ALLOA.) The banks and bed of this river are in general composed of soft mud or sleetch, which is daily brought down with the current, and gradually forms new ground. Opposite the Throsk is a ford, which is dry at low water, composed of large blocks of stone, chiefly of the kind termed greenstone. The mass of this species of rock nearest to this place is Stirling castle rock, and Abbey Craig, distant about four miles, from whence these stones must have originally come. Sand-stone rock appears at low water a little above the harbour of Alloa. There are salmon fishings on this river, but they are of very little value.

River Devon.

The river Devon takes its rise in the parish of Blackford, in the county of Perth, on the north side of the Ochill mountains. It runs eastward about 12 miles through the mountain glens, and then takes a sudden turn to the westward, at a place named the Crook of Devon, and keeps a western course till it falls into the Forth at the village of Cambus, immediately opposite to its source, which is only six miles distant in a north line. This river, after leaving the mountain district, flows through broken ground and rocks, which are chiefly of greenstone. These are worn into deep dark chasms, fearful to behold, and where the water is scarcely visible. One of these chasms is named the Deil's (Devil's) Mill, from an uncommon sound produced by the water very similar to that of machinery. Below this is the Rumbling Bridge, very narrow and without parapets, built across a narrow dark chasm, 90 feet deep; and further down the river is the Cauldron Lynn, where the water has scooped out the rock into the form of immense cauldrons, where it boils and foams without ceasing, and shews what strong effects even the attrition of water will produce. These objects are well worthy the attention of the naturalist, or the traveller of taste. This river, after dashing with impetuosity through rocky cliffs, at last flows placidly, in beautiful meanderings, through the picturesque and fertile valley of the Devon, till it joins the Forth. It is rendered classic by our poet Burns, who has styled it, *The clear winding Devon.* Through the valley the river flows upon a bottom of gravel, the banks being of a deep sandy loam, and towards the Forth they are of a strong clay. The tide flows only about half a mile up, where ships of small burden can enter.

River Black Devon.

The Black Devon is the only other river in the county. It rises among t the Saline hills in the county of Fife, passes north of the town of Clackmannan, and discharges itself immediately south from Clackmannan tower into the Forth. This river, from its source to its mouth, passes over strata of the independent coal formation, which is in many places exposed to view, and worthy the attention of the mineralogist. The tide only flows about a mile up this river, to a place named Parkmill.

Harbours.

The chief harbour and port in the county is Alloa, where there is excellent and safe accommodation for vessels. It has a customhouse, with a full appointment of officers; and as a port, comprehends Kincardine in the county of Perth, and Stirling, besides several intervening creeks on both sides of the river. At present, (1813) there are 10,000 tons of registered shipping belonging to the port, which are daily increasing. See ALLOA.

Mineralogy.

As to the minerals of the county, the rocks which compose them belong to two classes only, viz. the *transition*, and the *independent coal formation*. The Ochill mountains, which are on the north side of the county, are bold on the southern aspect, deeply indented (not rugged) in their horizontal line, with winding glens. *Bencleugh* is the highest of the range, being 2450 feet above the level of the sea, having a long flat summit or ridge. *Dun Myat*, or the *Hill of fair Prospect*, is 1345 feet above the level of the sea, and commands a most extensive and delightful view. The rocks which compose these mountains are of greenstone, flinty rock very splintry, basalt, amygdaloid, varieties of the trap class, petrosilex, and very coarse breccia, which latter composes the mass of rocks upon the western part of the mountains. Veins of lime-stone are found intersecting the hill strata. Beautiful agates (Scotch pebbles) are frequently found in the loose soil of the mountains; and also varieties of crystallized quartz, but of no value. Silver and copper have been wrought to a considerable extent in the Ochills. Lead and iron ore (hæmatites) have also been wrought on a small scale. Cobalt was found abundantly along with the silver, and ores of arsenic have also been occasionally found. These mining concerns have uniformly proved unsuccessful, and are now wholly abandoned, with considerable loss. In the veins, calcareous spar abounded, and barytes was found in large masses. The lead was wrought at Dollar, the silver and cobalt at Alva, the iron ore at Tillycoultry, and the copper at Blair-Logie and Airthry. There was a salt spring in the Airthry mines, but the kind of salt which impregnated the water was never tried. There is every reason to conclude, that these mountains abound with metallic veins. No mines or shafts have yet been driven under the level of the plain adjoining them.

Coal strata.

The strata of the coal field extends from the foot of the Ochills along the whole of the county, and are connected with the great coal field of Scotland. The coals found in this county are abundant, excellent, and valuable. The prevailing dip of the strata is to the north-east. The coal field is intersected with immense slips or dislocations of the strata, which have depressed the latter in some instances above 200 yards, forming distinct new fields of coal. Two main slips have been ascertained, and these run somewhat in a parallel line with the Ochills. Many diagonal slips have been discovered in working the coal of considerable extent, and a great number of small ones in every direction; still, however, the Clackmannanshire coal field is reckoned a clear field in comparison with other fields. Though the general dip of the coal strata here is to the north east, each seam of coal has a dip inwards from the wings or verges upon the line of bearing, so that each field taken simply in the abstract as a stratum of coal, is in its form the portion of a cup or flat bason, a form very generally found in coal fields. The Clackmannanshire coal strata keep the dip formerly mentioned, till the north field approaches the Ochill mountains, when the dip suddenly changes, and the strata rise towards the mountains, so that at their foot the various coal strata and coals are found conforming to the acclivity of the mountain face, and perfectly regular. **Coal strata.** The coal strata are cut through in many of the glens by the water, exposing to view objects highly interesting to the geologist. The junction of the coal strata with the mountain rocks is most distinctly seen at the Westertown Glen of Tillycoultry. The Ochills are the boundary line of the great coal field of Scotland upon the north, no coals having been found beyond them. The strata which compose this coal field are, varieties of sandstone, reddish, white, and grey colours, some of which are excessively hard, various kinds of shale or argillaceous shistus, bands of ironstone, and fire clay; greenstone, from its situation, may also be reckoned amongst the coal strata; as in one of the hill glens, it is either the lowest of the coal strata, or the first or uppermost of the mountain rocks, balls of ironstone are found abundant in the schist or shale. In the lowest series of the strata, and upon the verges of the coal field in the line of bearing, limestone is found, which arrangement agrees with many of the coal fields in Great Britain. Organic remains are found very abundant in the strata, particularly of the fresh water muscle in the ironstone, and of trees and plants in the sandstone, schist, and coal; many of these are of plants which are not found growing in Great Britain, but appear to belong to the equatorial regions. There has been ascertained in the Clackmannanshire coal field a great number of seams or beds of coal, varying in thickness from an inch to nine feet, amounting in the aggregate to fifty-nine feet of coal: the thinnest seam which has been wrought is twenty-seven inches thick. All the coals are of the open burning kind; and in general both cubical and slate coal are found in the same bed, which, in working, turn out in large quadrangular masses. None of the Scotch smithy coals are found here, or any in quality similar to the Northumberland caking coals. Many collieries have been opened and are now carrying on here; they are in every parish, Logie excepted, which lies west of the verge of the workable coal seams. Some of these collieries have been open for two centuries, and are wrought to a considerable extent, the deepest pit being about fifty-five fathoms. The collieries, as to the scale of working, stand thus: Alloa, Sauchy, Clackmannan, Dollar, Kennet, Tillycoultry. The present annual output of coals may be taken at 130,000 tons, the greater part of which is exported to Leith, Taywater, and Dunbar. The noxious air commonly generated in the coal mines is carbonic acid gas, termed choak damp; it issues continually from the fissures of the whole (heal) coal and from the strata adjoining. Attention requires to be paid to the ventilation of the pits, otherwise this gas would quickly accumulate, and prevent the workmen entering the mine. No vestige of (inflammable air) hydrogen gas was ever seen in the coal mines till lately, when, in driving a stone mine at Old Sauchy colliery, it accumulated and exploded without producing any bad effect. The water produced in the mines is very hard, being in general much impregnated with lime and sulphur. **Ironstone.** Ironstone is the only other mineral wrought to any extent, which is used at the Devon iron furnace, in the parish of Clackmannan; it is of the common argillaceous kind, and yields from 25 to 30 per cent. of iron. Freestone is found in abundance, but none of it is remarkably fine either in colour or quality. Large blocks of greenstone are found thinly scattered over the surface of the county; but as no rock mass of that kind is found nearer than six miles to the westward, many theories have been given by philosophers, as to the natural means by which they have been transported from their original rock. The great mass of greenstone rock in this county is Abbey Craig near Stirling; it is bold, rugged, and precipitous towards the south-west, and slopes or dips to the north-east, having no superincumbent rock strata. The bottom of the precipice is covered with huge blocks of this rock, which in former ages must have fallen down. This rock, in its general structure, is rudely columnar, above 100 feet thick, and rests upon the common alternating series of coal strata, composed of sandstone, shale, and coarse limestone, mixed with iron. In this last, petrified shells are abundant. The surface slope of this immense rock seems to conform with the dip of the strata on which it rests, a point in the mineral field, worthy of the attention of the geologist. This rock, in its fracture, is found both of an open and close grain, and of crystallised appearance, composed of feldspar and hornblende, with minute crystals of pyrites. It is difficult to break under the hammer. It is tough rather than splintery. It dresses with a regular face, similar to the Aberdeen granite; but its particles are much more cohesive than the granite: this superior quality induced an ingenious miller, of the name of Brownhill, to try this rock as a substitute for French burstones in the manufacture of flour, as the burstones, on account of the war, had become very high in price; he succeeded beyond his expectation. And so much are these millstones approved of, that they are in general request both for flour mills and distilleries for gristing. They are built in pieces, similar to the burstones; are uniform in the cutting surface, and dress well, a quality deficient in the burstones. As a proof of their utility, above 300 pairs of these millstones are now used in Scotland and England. They sell at from sixteen to twenty guineas a pair, whereas burstones cost about sixty guineas; hence an important acquisition is made, and also a great saving of expence. The Society for the encouragement of Arts, presented Brownhill with one hundred guineas for the discovery.

Manufactures. As to the manufactures carried on in the county, that which is upon the greatest scale, and in which large capitals are embarked, is the distillation of spirits, (whisky.) There are no less than six large distilleries in this small district: Kilbagie, in the parish of Clackmannan, is the most extensive. These works yield to government a revenue of about L. 723 per annum, on each gallon of the licensed still, when working from grain, and employ a great number of people; part of the spirits is sent to London, but the greater part to Leith and Glasgow. When the distillation from corn is allowed, great numbers of cattle are fed at these works from the grains and dreg, and the consequent produce of manure, has greatly contributed to the high improvement of the adjoining lands. It is estimated that every gallon of licensed still will produce grain and dreg to fatten, in the best manner, two oxen of 40 stones (Dutch) each; but when sugar is used in distillation in place of grain, no cattle are fed. These works are carried on in the most scientific, regular, and systematic manner; and, it is remarkable, that the workmen employed at them are a very sober set of people, notwithstanding the free access they have to spirits at all times.

Ales are made to a considerable extent in Alloa: they have a name in the market, and are in great request both in Scotland and England.

The making of pig-iron is carried on at the Devon iron-works, in the parish of Clackmannan, where there are two blast furnaces, impelled by a powerful steam engine. About 60 tons of pig-iron is produced here weekly; a small part of it is used by a foundry at the works, but the greater part is sold to other founders. The manufacture of coarse woollen cloth, named serges, has for a long period of years been carried on at Tillycoultry, and still continues; and there is a woollen manufactory at Alloa on a small scale; there is, besides, manufactures at Alloa for common glass bottles, bricks, tyles, ropes, sails, common pottery, and leather. There is a bleachfield of considerable extent at Dollar, chiefly employed by the Dunfermline table damask manufactories, and the distillation of the pyroligneous acid is carried on in the parish of Clackmannan: the acid is sold to the chemical works at Glasgow, and the charcoal to the founders. This is an object to which more attention might be paid in Scotland, where woods are cutting, provided there is a full demand for the acid. Ship-building is carried on at Alloa, where there is an excellent graving dock for vessels of large burden. There are many muslin weavers all over the county, but these are all employed by Glasgow houses.

Machinery. There is much machinery in the county, driven by water, steam, and horses; it is generally constructed on the most approved principles, and some of it very powerful. There is a steam engine at Sauchy, which lifts, from the depth of 280 feet, a million gallons of water every 24 hours.

Antiquities. Regarding antiquities, the towers of Clackmannan and Alloa are upwards of 500 years old, and there is an old baronial tower at Sauchy in a retired situation. The abbey tower of Cambuskenneth, in the parish of Logie, is also of considerable antiquity: In this abbey it is said that several of the kings of Scotland are buried, and in particular James III. These towers are of a rectangular form, and built with large square stones, the masonry plain and substantial, the walls of Alloa tower being eleven feet thick. Castle Campbell, in the parish of Dollar, named also Castle Gloom, is a ruin of ancient date; the time of its being built is not exactly known, but it was in possession of the Argyle family in 1465; it is most romantic, wild, and gloomy, as to situation; is built on an insulated conical hill, above which the surrounding hills rise to a great height immediately adjoining excepting on the south. There is a singular narrow cut made in the solid rock, from the south front of the castle to the bottom of the glen, named Kemp's Score; it is said to have been a stair for procuring water for the castle. John Knox, the celebrated reformer, preached in front of this castle; and here the sacrament of the supper was dispensed amongst the first times it was dispensed in Scotland. Roman and other ancient coins have been found in this county, and also a few very ancient weapons.

Roads. With respect to eminent persons, natives of this county, the names of Bruce, Erskine, and Abercromby are conspicuous: they are enrolled in the page of history, and in other parts of our work they have received the tribute which is due to their memory.

Projected improvements. The county roads are excellent, and in every direction, which have tended much to improve the country. An improved cast-iron rail-way is laid from the Alloa colliery to the harbour, where a horse brings down eight tons of coals, and returns with the empty waggons, so that one man and one horse do as much work in one day, as 27 horses and 27 men did in the same time 60 years ago. There is a good ferry at Alloa to the opposite side of the river; and three packets sail regularly betwixt Alloa and Leith. Amongst the projected improvements in this district, a survey was made by Mr Rennie, the celebrated engineer, in order to ascertain the expence of throwing a bridge across the Forth at the Alloa ferry. He pronounced the work practicable, and gave a handsome design for an iron bridge, the estimate for which was £150,000. This bridge would be of great benefit, but the expence is such as to prevent the plan from being executed at present. Another evident improvement which has been projected, is a canal from Alloa through the Carse of Stirling. This would be of the greatest benefit, as by its means lime and coal could be carried with ease into a country in great want of these articles. Grain, slates, &c. would be returned; as the ground through which the canal would pass is flat, and composed of clay, the expence would be very moderate. A project was brought forward many years ago, by the commissioners for the improvement of Scotland, to render the Devon navigable; a plan and estimate was made, but no steps were taken to carry the scheme into effect. A branch from the before-mentioned projected canal would be more suitable for trade, on account of the heavy floods which occasionally happen in the Devon.

There are several artificial collections of water in the county for the purpose of driving machinery, the largest of which is Gartmorn Dam, made about 100 years ago by John, Earl of Mar: it covers 120 Scotch acres of land; the supply of water is brought from the Black Devon by an aqueduct some miles in length; an engineer from Wales was brought by the Earl to give his advice regarding this work, and for improving the hydraulic engines, by which all collieries, not level free, were then drained.

All kinds of timber grow well in the county, and there are many trees of very large size. The plantations are increasing every year, and are very thriving.

There are no poors rates in the county, the poor being supported by collections at the church doors and voluntary contributions. A gentleman of the name of M'Nab some years ago bequeathed, by his will, a large sum for *the education of the poor of the parish of Dollar*, which sum is now accumulated to above L. 40,000: it is not easy to conceive how so large a sum is to be applied in strict conformity to the destination of it.

The exports are chiefly coals, spirits, pig-iron, bottles, bricks, tyles, and ales. The imports are chiefly grain, sugars, timber, lime-stone, malleable iron, and groceries.

The valued rent of the county, according to the cess books, is L. 26,482 : 10 : 10, Scotch money. The population in 1811 was 11,719 souls. (R. B.)

CLADIUM, a genus of plants of the class Triandria and order Monogynia. See BOTANY, p. 113.

CLAIRAUT, ALEXIS CLAUDE, a celebrated French mathematician and natural philosopher, was born at Paris on the 13th of May 1713. His father, Jean Baptiste Clairaut, who was a teacher of mathematics at Paris, and member of the Royal Academy of Sciences at Berlin, had no fewer than 21 children. Our author was the second child, and the third was carried off by a premature death at the age of 16, after he had published an able work on the quadrature of the circle, and the hyperbola.

Young Clairaut was taught the alphabet upon the figures of Euclid's Elements, and such was the rapidity of his progress, that, at the age of 4 years, he was able both to write and read. He was instructed in the principles of arithmetic by the most simple and ingenious methods; and a love of the military profession, which he early displayed, was employed by his father as a powerful stimulus to the study of mathematics, and other branches of knowledge, which were represented as necessary accomplishments in a young soldier.

At the age of nine years, his attention was directed to M. Guisnee's Treatise on the Application of Algebra to Geometry. With the help which he received from his father, he speedily read this work, and, after studying it a second and a third time by himself, he resolved the greater number of the problems in a more simple and ingenious manner than the author himself. Clairaut now began to experience the delight which springs from the successful exercise of genius, and he continued his studies with an intensity of application, which, if not seasonably checked, would have endangered his health. At the age of ten, he read the Marquis de L'Hopital's Conic Sections, but he experienced considerable difficulty in making himself master of the subject. M. de Lisle, who was visiting his father, happened to see young Clairaut with this volume in his hands, and remarked, with a kind of sarcastic severity, that he could understand this book only by its title and its cover. The young geometer was affronted with the remark, though he felt it to a certain degree true, and he gave himself no rest till he was completely master of the subject. He next studied the analysis of infinites of the same author, and initiated himself into the differential and integral calculus.

The reputation of Clairaut, which was hitherto confined to his own friends, now began to extend with rapidity. The celebrated M. Nericaut Destouches having just arrived from England with his lady, who was about to be confined, took lodgings immediately below the house of Clairaut, and sent up a request to the family to make as little noise as possible, both on account of his wife's indisposition, and as he was himself employed in writing his fine tragedy of the *Philosophe Marié*. This request was so scrupulously attended to, that M. Destouches went in person to thank M. Clairaut for his kindness. He was surprised to find, that he had been living below a family of 11 children; and he was so much pleased with the young mathematician, that he introduced him to the Abbé Bignon, and to other celebrated members of the Academy.

About this time, M. Clairaut removed to another house, in which there was a small room, which was allotted to the use of our author and his younger brother, of whom we have already spoken. This room was so situated, that they could go in and come out without being perceived, and the two brothers did not fail to abuse this advantage. They procured a flint, by means of which they might light their candle, and when the family imagined them to be buried in sleep, they were eagerly engaged in the study of geometry. Alexis was now secretly occupied with a memoir on four curves of the third order, which he had newly discovered, and by means of which he could find any number of mean proportionals between two given lines, and he wished to surprise his father with this memoir when completed. Before it was finished, however, the geometrical plot was detected, and the young culprits received a severe reprimand. Delighted with the discovery of the new curves, M. Clairaut presented his son to the Academy of Sciences, for the purpose of reading his memoir to that learned body; but his size bore so slender a proportion to the abilities which were displayed, that it was only after a rigid examination of the young man, that the academicians believed him to be the author of the discovery. Father Reyneau, whose *Analyse Demontrée* had first roused the genius of D'Alembert, and who was present at this meeting of the Academy, burst into tears of joy at the exhibition of such wonderful and premature talents. The memoir of our author was published in the *Miscellanea Berolinensia* for 1724, with an honourable certificate from the Academy.

About this time, Clairaut laid the foundation of his excellent work *Sur les courbes a double courbure*, which he finished at the age of 18, with an assiduity which threw him into a violent fever. He continued his investigations on this subject, and in 1730 they were published, with a certificate from the Academy, which expressly stated, that the author had accomplished, at the age of 16, what would have done honour to the most celebrated geometers.

The academicians were now desirous to rank Clairaut among their number; but, by the rules of the Academy, this could not be accomplished till he had reached his 20th year. Application was, however, made to the king, and a special dispensation was granted in favour of the young candidate, who, on the 14th July 1731, was admitted adjunct mechanician at the early age of 18.

The joy with which this event naturally inspired M. Clairaut and his family, was painfully alloyed by the death of the younger brother, whom we have already mentioned, and who was carried off in two days by the small-pox.

After Clairaut had recovered from this dreadful shock, which for a while threatened his own life, he chearfully accepted an offer from M. Maupertuis, to accompany him to Basle on a visit to John Bernoulli. On his return from this excursion, with which he was peculiarly delighted, he found his associates in the Academy occupied with the question of the figure of the earth, and he resolved to devote his attention to this important subject. With this view, he and M. Maupertuis retired to Mount Valerien, where they formed the project of a voyage to Lapland, in the execution of which our author was of the most essential service. The Marchioness of Chatelet having taken a fancy for the study of geometry, went frequently on horseback to visit Clairaut at Mont Valerien; and it was for this lady that he composed his *Elemens de Geometrie*, which appeared in 1741.

After his return from measuring a degree of the meridian in Lapland, the king granted him a pension of a thousand livres, which in less than a year was followed by another that had been vacated by M. Chevalier.

In the year 1758, on the death of Bouguer, his pension of 3000 livres was divided between Clairaut and Le Monnier; and in consequence of this encouragement, he laid before the Academy an excellent Memoir on Naval Tactics.

It would lead us much beyond the limits of a biographical article, were we to follow Clairaut through the numerous memoirs which he communicated to the Academy of Sciences. The progress of his researches, and the various subjects which attracted his attention, will be more readily seen from the list of his Memoirs which is given at the end of the present article. We shall therefore only notice at present such of his works as have been most conducive to the advancement of science.

In his *Theorie de la Figure de la Terre suivant les principes de l'Hydrostatique*, which appeared in 1743, he has treated this interesting subject with unusual ability. He has determined, upon the Newtonian theory, what would be the figure of the earth if it were wholly fluid; and either uniformly dense, or consisting of concentric strata of variable density: He has examined what would take place if a part of it were rendered solid; and by an application of the same principles, he has given the first philosophical theory of capillary attraction.*

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* See CAPILLARY *Attraction*, vol. v. p. 411. where we have given an account of Clairaut's Theory.

In the year 1747, Clairaut shared the honour, along with Euler and d'Alembert, of having solved the problem of three bodies. In the three solutions of this great problem which had been separately obtained, without any communication, by these illustrious mathematicians, it turned out, to the astonishment of them all, that the calculus gave only half the observed motion of the moon's apogee. Clairaut proposed to make a slight alteration upon the law of gravity, in order to produce a correspondence between the theory and the observations; but this idea was warmly attacked by Buffon, and Clairaut at last discovered that he and his learned associates had neglected some small quantities in the series, and that the result thus corrected was perfectly consonant to the theory of gravitation. He gained the prize for this subject, which was given in 1751 by the Academy of St Petersburgh, and in 1754 he published his Lunar Tables, which were founded upon his own solution of the problem of three bodies, and which greatly exceeded in accuracy those that had been formerly in use. A new and correct edition of this work was published in 1765.

The application of the problem of three bodies to the theory of the comet of 1759, formed the most important epoch in the life of Clairaut; but as we have already discussed this subject at sufficient length both in the article Astronomy and in the life of D'Alembert, we cannot resume it in this place.

Next to the lunar theory, the most important subject which then exercised the genius of mathematicians, was the improvement of the achromatic telescope. This subject occupied much of Clairaut's attention, and he published the result of his researches in three memoirs, which appeared in 1756, 1757, and 1762, and which contain a most complete investigation of the various forms in which achromatic object glasses may be constructed. In the course of this enquiry, Clairaut discovered that the coloured spaces in equal spectra produced by substances of different dispersive powers, were not proportional, and therefore that a *complete* correction of colour could not be effected by two kinds of glass. This beautiful discovery of a secondary spectrum was made about the same time by Boscovich, without any knowledge of what Clairaut had done; and this able mathematician has shewn how a more complete correction of colour may be obtained by employing three different substances in the construction of the object-glass. This curious subject, so intimately connected with the perfection of the achromatic telescope, has been recently investigated by Dr Brewster, who has determined the relative proportions of the coloured spaces for a great variety of transparent bodies. He has found that the uncorrected colour generally increases with the difference between the dispersive powers of the two substances by which the opposite dispersions are produced; that sulphuric acid exceeds all transparent substances in its action on the green rays, while oil of cassia exerts the least action upon them of any known substance, and that there is a *tertiary spectrum* which may be formed even when the opposite dispersions are produced by two prisms or lenses of the same substances. The application of these results to the improvement of the achromatic telescope, will be pointed out in the article Optics.*

In order to render his investigations of real utility to the practical optician, Clairaut began to reduce all his results into tables, and to compute the thickness and radii of the different lenses which were requisite to form an achromatic object-glass; but he unfortunately did not live to finish this work. Although he had laid down a rule never to sup in Paris, yet he was on one particular occasion induced by some of his friends to transgress it. So fatal was this rash indulgence, that he scarcely lived to repent it. He was attacked with indigestion and rheumatism, which baffled the skill of his physicians, and carried him off on the 17th of May 1765, in the 52d year of his age.

List of Clairaut's separate works.

The following is a list of the works which he published separately.

Recherches sur les courbes á double courbure. Paris, 1730, in 4to.

Eléméns de Géometrie. Paris, 1741, in 8vo.

Eléméns d'Algèbre. Paris, 1746, in 8vo.

Théorie de la Figure de la Terre. Paris, 1743, in 8vo.

Tables de la Lune. Paris, 1745, in 8vo.

List of his Memoirs.

The Memoirs which he published in the *Memoires de l'Academie* are the following:

Observations sur un instrument par le moyén duquel on peut prendre les Angles, et faire les calculs arithmetiques, 1727. Hist. 142.

Nouvelle maniére de trouver les formules des centres de gravité, 1731, 159.

Obs. sur les courbes que l'on forme en coupant une surface courbe quelconque par un plan donné de position, 1731, p. 483.

Des épicycloïdes sphériques, 1732, p. 289.

Maniere de trouver des courbes Algébriques et rectifiables sur la surface d'un cone, 1732, p. 385.

Solution d'un problême de Géométrie, 1732, p. 435.

Obs. sur quelques questions de *maximis* et *minimis*, 1733, p. 186.

Determination Géométrique de la perpendiculaire, à la méridienne, tracée par M. Cassini, avec plusieurs méthodes d'en tirer la grandeur et la figure de la Terre, 1733, p. 406, H. 59.

Solution de plusieurs problêmes, où il s'agit de trouver des courbes dont la propriété consiste dans une certaine relation entre leurs branches, exprimée par une équation donnée, 1734, p. 196.

Remarques sur la méthode de M. Fontaine, pour résoudre le problême ou il s'agit de trouver une courbe qui touche les côtés d'un angle constant dont le sommet glisse dans une courbe donnée, 1734, p. 531.

Obs. sur le nouvelle méthode de M. Cassini pour connoître la figure de la Terre, 1735, p. 117. H. 51.

Examen des différentes oscillations qu'un corps suspendu par un fil, peut faire lorsqu'on lui donne une impulsion quelconque, 1735, p. 281, H. 92.

Examen de la résponse de M. Fontaine á mes objections, sur la méthode pour trouver une courbe qui touche continuellement les côtés d'un angle constant dont le sommet glisse dans une courbe donnée, 1735, p. 577.

Solution de quelques problêmes de dynamiques, 1736, p. 1. H. 105.

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CLAIR OBSCURE. See PAINTING.

CLARE, a county of Ireland, in the province of Munster, bounded to the south and east by the Shannon, which divides it from the counties of Tipperary, Limerick, and Kerry; on the west by the Atlantic ocean; and on the north by the county of Galway. It extends from north to south 33 English miles, from east to west 66, and its superficial measurement is about 1195 square miles. The sea-coast by which this county is bordered, consists of a chain of basaltic rocks. Towards the centre of it is an arm of the sea, or rather of the Shannon, known by the name of the Fergus river. It is remarkably bare of wood, and abounds so much with limestone, that whole tracts are entirely beds of it, the surface even having the appearance of a mass of stone.

Soil.

The soil in this county is of various quality, some being of the nature of fattening and meadow ground, other parts consisting of light limestone pasture fit for rearing sheep and young cattle, and there is a great deal of arable land; likewise extensive bogs, and some mountain land. Mr Young states that the Corcasses, a tract of ground consisting of about 20,000 acres, which extend along the Fergus and the Shannon, are peculiarly adapted to the fattening of bullocks, and that at the time he travelled there, 4000 were annually fattened on them. At present also, the store-cattle of Clare are more numerous than in any of the adjoining counties. Mr Young describes the soil of the Corcasses as either a rich black loam, or a deep rich blue clay. The higher lands are chiefly limestone, or limestone gravel. The bogs in the county afford a valuable supply of fuel. Those particularly near the Shannon yield a handsome return to the proprietors, by furnishing this article for the Limerick market. The worst grounds in the county are the eastern mountains, the peninsula north of the Shannon, and the barony of Burren. Even this last, however, by the luxuriant pasturage interspersed among the seemingly barren hills, affords support to great numbers of cattle and sheep; and the rocks themselves are limestone. The rent of the green land, without including the Corcasses, has been averaged at a guinea and a half per acre. The latter are let so high as from 3 to 5 guineas per acre.

Agriculture.

The kind of grain chiefly cultivated in the county of Clare, and indeed in the whole of the surrounding district, is oats; and the establishment in this quarter of corn-buyers, who ship that grain for Scotland, has induced the farmers to sow with it many acres in these parts, which would otherwise have been covered only with sour grass. Indeed a large portion of the tillage of this county, especially that on the sides of mountains, or amongst rocks, is performed by the spade, the unevenness of the surface, as well as often the circumstances of the cultivator, not admitting of the use of a plough and horses. Rape is sown here in considerable quantity on the mountain or boggy grounds. Some of the seed which is the produce, is pressed into oil at mills near Killaloe, and the rape cakes are sent to England for manure. For the most part, however, the rape seed is sent thither in its original state, and it is there pressed, for the use of the woollen manufacturers in Yorkshire. Beans were formerly grown here in large quantities, but since they have ceased to be used for bread by the peasantry, the cultivation of them has been laid aside. Flax is sown, but not extensively, for home consumption. In the preparation of the ground

for some of the crops, chiefly rape and potatoes, the practice of paring and burning, though illegal, and though much discountenanced by landlords, is still retained in this county, as well as in other parts of Ireland, especially where the ground is coarse, and in a little improved state. Some attempts have also been made towards increasing the value of the bogs in the county by means of irrigation, which has the effect of converting them into good meadow land.

Cyder orchards.

The cyder orchards of Clare have been much noticed, but they seem to be at present upon the decline. With respect to the Cackagee cyder, the extraordinary flavour of which has been so highly celebrated, there is rather a want of accurate information. Some say, that the finest is made from the juice of the first squeezing, that of the second being reserved for the common cyder; while it is asserted by others, that only one side of the apple, namely that which hangs towards the sun, is employed in the preparation of the best kind of cyder; and some allege, that the apples are thrown into heaps, and are not squeezed till they have attained a certain degree of fermentation. It does not appear, that the species of fruit from which this produce is obtained, is much cultivated, nor itself consequently of much importance. The apples from which it is made are of a remarkably sour nature, and grow chiefly in the neighbourhood of the sea, and in parts where there is seldom any frost or snow. They are said to be bad bearers, to which may in part be owing the scarcity of the article.

Plantations.

Though in the county of Clare one may travel for many miles over limestone rock without seeing so much as a bush, and though there is perhaps hardly any thing in it which merits the denomination of a wood, there are yet some plantations. The extent of ground which these cover has been estimated to be to the amount of nearly 800 acres.

Cattle.

Clare produces excellent cattle of the long-horned breed. There are also large flocks maintained here of long woolled sheep. The regular dairies in the county are few. Some persons let their cows to their tenants, whose wives retail the milk with a very considerable profit. Sheep's milk is frequently mixed with cow's milk for the market; and the filthy custom still prevails of permitting the calf to suck two teats while the dairy maid empties the other two, the consequence of which is that the dribbling from the calf's mouth falls into the pail.

Manufactures.

In respect to manufactures the produce of the county of Clare seems hardly, in any instance, to go beyond its own consumption. Spinning is by no means prevalent, and the excellent Clare dowlas is scarcely any longer known. The only manufactures indeed for which there is a market within the county, are coarse flannels and worsted stockings. At the same time, it is to be observed, that the wearing apparel of the lower orders, is, for the most part, prepared in their own families. The usual clothing of the men is a kind of frieze thus made at home, and which is of a much superior quality to what is commonly to be had in the shops. Some parts of the women's dress are often of the same kind, or more frequently of a coarse flannel dyed of a bad red colour, which is also of their own preparation. Kelp is made along the shore of this as well as of the adjoining counties. Sea-weed, in general, has been long known as a valuable manure. Sea sand also, with which this coast abounds, is used here for the same purpose, to a great extent, and with proportionate advantage.

Harbours.

The west coast of Ireland, in general, is subject to extremely violent storms. It is said that near Doolen, in this county, blocks of limestone, 10 or 12 feet in diameter, are thrown up sometimes on ledges of rocks, which are several feet in height. At the same place there is a barrier of water-worn stones, some of them many tons in weight, raised above 20 feet high across a small bay where fishermen used to land from their boats, and where their former quay, surrounded with huts, remains many yards from the sea. Against the fury of the winds prevalent in this quarter, though there is no want of harbours on the coast, yet along the whole extent of this county there is not one in which ships may lie with safety. Its ports on the Shannon are by no means considerable.

Rivers.

The only rivers in the county of Clare that are deserving of notice, are the Shannon and the Fergus. The former of these, as it approaches the confines of this county, is expanded into Lough Deingheart. It contracts its limits again from the vicinity of Killaloe, but between Clare and Kerry, the breadth of this noble river varies from one to five miles. The Fergus, which is the principal river that has its source within the county itself, admits not of the navigation of any vessels of greater burden than sloops. Its estuary, however, at its junction with the Shannon, is very wide and full of islands. This river, and indeed several others in Clare, dip under ground in some part of their course.

Lakes.

There are in this county also many turlachs, or spots, which at one time are lakes, and at another sound sheep walks. The most remarkable of these is that at Kilcorney, in Burren, where the waters issuing often more than once a year from a spacious cave, deluge the whole adjacent flat grounds. There are some lakes in the county, but none of much consideration.

Plants.

The plants and minerals with which the mountainous and stony parts of the county of Clare abound, are many of them deserving of attention. There are found here several of those which are considered to be the rarer plants of Ireland. Such are the *Iris fœtidissima*, the *Arbutus uva ursi*, the *Rubus saxatilis*, the *Cardamine bellidifolia*, the *Asperula cynanchica*, the *Lysimachia vulgaris*, the *Butomus umbellatus*, the *Sedum telephium*, the *Potentilla fruticosa*, the *Dryas octopetala*, the *Mentha pulegium*, the *Turritis hirsuta*, the *Cheiranthus sinuatus*, the *Gnaphalium dioicum*, and the *Satyrium hircinum*.

Minerals.

The mineralogy of the county has been but little explored. Lead ore is said to occur in various places; in some of which it was formerly raised and smelted. Manganese is abundant, and there are different ores of iron, particularly micaceous iron ore, and red iron stone. Boate mentions iron works in Clare, which belonged to English merchants, in the early part of the 17th century. At Doolin in Burren, there has been found a vein of purple fluor spar, similar to that brought in ornaments from Derbyshire, some of the specimens having cubic crystals; but the extent of the vein is not known, and no attempt has been made to apply it to any useful purpose.

Political division.

Clare county is divided into 9 baronies, and 79 parishes, most of which are comprehended within the united sees of Killaloe and Kilfenora. These 79 parishes, in consequence of unions, form only 30 benefices, which too have not all churches. The proportion of the Catholics to the Protestants in this county, has not been very precisely ascertained. The gentry are, for the most part, members of the established church. But the graziers, who possess very considerable property, both in leases and stock, are said to be all of the Catholic religion. Indeed, it has been alleged, that the tenants are universally Catholics; those who pretend to be Protestants being, in fact, so only in appearance, and from interested motives. The Catholics in this county are certainly very numerous. Two gentlemen of this persuasion are called on the grand jury. The county militia consists almost entirely of Catholics, with the exception of the officers.

Population. The number of inhabited houses in the county of Clare, was, in the official return of 1791, stated to be 17,396, from which the amount of the population may be concluded to be about 104,000. Two members represent this county in the House of Commons. There is one also for the burgh of Ennis. This, which is the county town, is situated on the Fergus, and is the only town of note in the shire.

History. The ancient name of the county of Clare was Thomond. It was a principality under the O'Briens, descendants of Brien Borombe, the King of Ireland, who was slain fighting against the Danes A.D. 1014. One of the family was acknowledged King of Thomond by Henry III.; and Murrough O'Brien, on resigning the old title of prince, was made Earl of Thomond by Henry VIII. Thomas de Clare, son of the Earl of Gloucester, having come to Ireland in 1276, and settled in this county, had a large portion of it conferred on him in property by its petty prince, or, according to other accounts, by King Edward I. From him, or some of his family, the county received its present name. It had always been considered as a part of Munster, as is implied in its original appellation; but when Connaught was divided into counties in 1562, Clare was included in their number. As at that time, however, each province had a peculiar governor, called lord president, and as the earls of Thomond having possessions in other parts of Munster, were mostly connected with it, they obtained, upon their petition, to have the county of Clare again comprehended under that province in 1602. In this connection it has since continued, and its bishopric is subordinate to the primacy of Munster.

In the county of Clare, there are several interesting remains of antiquity; such as the Ogham inscription on Callan Mount; also various ruins, particularly those of Quin Abbey, and the island of Inis Scattery. See Beaufort; Young; and Wakefield's *Statistical and Political Account of Ireland, &c.* (K)

CLARET. See WINE.

CLARINET, in music, is a wind instrument, very common in military bands, having, however, rather a coarse croaking kind of tone, except in the hands of the most expert performers, some of whom have places in the best concerts.

C and F are the only keys that are usually in good tune on the common clarinets, the scale of which reaches from E below the bass cliff, to *e*, an octave above the treble stave. For general use in the orchestra, the performers have also B♭ clarinets, A clarinets, D clarinets, B clarinets, and G clarinets, for accompanying pieces in these keys. John Christopher Denner, of Leipsic, is said to have invented this instrument, sometime about the year 1600. (ϱ)

CLARION-STOP, in music, is the name of a range of reed pipes on the organ, sometimes called the octave trumpet-stop, from its near resemblance to the upper notes of that instrument. The notes of this stop are tuned an octave higher than those in the open diapason, and an octave higher than the trumpet-stop. The clarion-stop is never used alone, but in conjunction with other stops, to give power and effect to the chorus parts. (ϱ)

CLARISIA, a genus of plants of the class Diœcia, and order Diandria. See BOTANY, p. 340.

CLARKE, SAMUEL, an eminent divine and philologist, was born at Norwich in the month of October 1675. His father, Mr Edward Clarke, a gentleman of high respectability, was an alderman of that city, and for some years one of its representatives in parliament. After acquiring in the grammar school of Norwich a considerable acquaintance with the learned languages, young Clarke was, at the age of sixteen, entered a student at Caius College in Cambridge. Here the splendour of his talents, and his unwearied assiduity in the pursuit of knowledge, soon attracted general admiration. The ingenious but fanciful theories of Descartes were still held in high esteem, and taught with enthusiastic zeal in the university of Cambridge. But their fallacy was easily detected by the penetrating genius of Clarke, who, young as he was, had carefully studied and thoroughly understood the *Principia* of Newton, then recently published; and while the sublime discoveries of that great philosopher were slowly making their way against ancient prejudices, and were comprehended and appreciated only by a few profound mathematicians, this youthful admirer was meditating the most effectual plan of recommending them to more general observation. With this view he undertook the arduous task of translating from barbarous into elegant Latin, Rohault's *System of Philosophy*, then the text book in the university, to which he subjoined a variety of judicious and excellent notes, calculated to lead the student insensibly to the perception of the absurdities of the Cartesian hypothesis, and to the adoption of the new theory. This task he executed with great ability, and complete success. His translation of Rohault, passing through four editions, continued for many years the standing text-book in the university, till it at length gave way to the avowedly Newtonian publications of Rutherforth and Rowning.

Having directed his views to the church, he now gave his whole attention to the studies which he considered necessary to qualify him for the able and faithful exercise of the sacred office. He began by perusing, in the original languages, the scriptures of the Old and New Testament, and the writings of the primitive Christian fathers; his accurate knowledge of which is admirably displayed in many of his theological publications. Soon after taking holy orders, he was introduced by Mr Whiston to Dr Moore, bishop of Norwich, an ardent admirer of literature, and a zealous patron of learned men. On the collation of Whiston to the living of Lowestoffe, (1698), the bishop appointed Mr Clarke his domestic chaplain. During the twelve years that he remained in this situation, he lived with his learned patron on the friendly and familiar habits of a brother; and the bishop, at his death, gave the most unequivocal proof of the high value which he entertained for him, by confiding to him the entire management of his family concerns.

In 1699, he published *Three practical Essays upon Baptism, Confirmation, and Repentance*, and anonymous reflections on part of a book called Amyntor, the production of Toland, who rejected as spurious the writings ascribed to some of the apostles and primitive Christians, and refused to acknowledge the inspiration of the evangelists St Mark and St Luke. These publications, though inferior in literary merit to the subsequent productions of our author, are highly creditable to his piety, and show him to have been, even at his outset in his theological career, intimately acquainted with the practices and the writings of the early Christians. His next publication was a "Paraphrase on the Gospel of St Matthew," which appeared in 1701, and was soon followed by Paraphrases on the other three Gospels of Mark, Luke, and John. His object, as he himself informs us, was to "express the full sense of the evangelists in the plainest words, and to continue the sense without interruption, by the clearest transitions he could." The admirable manner in which he has executed this undertaking, leaves us much reason to regret, that other avocations prevented him from pursuing his original intention of giving a similar paraphrase of all the books of the New Testament.

About this time, he was presented with the rectory of Drayton near Norwich, by his friend Dr Moore, who likewise procured for him a parish in that city. While he continued in that situation, he preached without notes, a practice in which he is said to have been peculiarly happy. But his powerful talents were soon to be exerted on a more conspicuous theatre. He was appointed in 1704 to preach at the lecture founded by Mr Boyle, and chose for his subject *the being and attributes of God*; his discourses on which interesting and difficult subject gave so much satisfaction, that he was reappointed to the same office the following year, when he delivered a series of sermons on the *Evidences of Natural and Revealed Religion*. In his discourses on the divine nature and attributes, he adopted the *a priori* mode of reasoning, which, though less intelligible to common minds, and therefore less generally useful than the opposite mode, is, when conducted with the abilities of a Clarke, by far the most satisfactory, and may be regarded as the highest effort of the human understanding. It was preferred by Mr Clarke, not from any conviction of its superior utility, or any ambitious desire to display his metaphysical powers; but as Hobbes, Spinoza, and other infidel writers, had employed metaphysical subtleties against religion, he thought it proper to shew that the same mode of reasoning might be employed, with greater effect, in its service. The uncommon ability with which he executed this undertaking, entitles him to rank in the highest class of metaphysicians; and he has merited the gratitude of all the friends of religion, by placing this particular proof of the existence of God in the clearest light of which it will, perhaps, admit. In his discourses on the evidences of religion, he traced the foundation of morality to the mutual relation of things and agents, to the unalterable fitness or unfitness of actions, and to the will of the Creator, evident from his making men capable of perceiving these relations and that fitness, of judging concerning them, and acting according to his judgment. He next proceeds to demonstrate, that the Christian religion is worthy of God, from the perfect conformity of its main design to the light of nature, and to all the moral obligations of eternal reason; and then proves, from the external evidence of prophecy and miracles, that this religion was actually revealed from heaven. This work, though it excited a host of opponents, is of inestimable value, as it contains the most irrefragable proofs of the divine origin, authority, and obligation of the Christian system.

The ardent wishes of his patron for his removal to London, as a scene both of honour and of usefulness more adequate to his splendid talents, were at length gratified in 1706, when his interest procured for Mr Clarke the rectory of St Bennet, Paul's Wharf. In the same year he published his letter to Mr Dodwell, who, in his *Epistolary Discourses*, had advanced the very strange positions, that the soul is a principle naturally mortal, but immortalized actually by the pleasure of God to punishment or reward, by its union with the divine baptismal spirit; and that none, since the apostles, have the power of conferring this immortalizing spirit, excepting only the bishops. This letter, says Bishop Hoadly, gave universal satisfaction; yet it engaged Mr Clarke in a new controversy, particularly with Collins, who, in his *Enquiry into Human Liberty*, produced every thing that could be plausibly said against the immateriality of the soul. This controversy, however, did not prevent the indefatigable mind of Clarke from publishing, in the same year, a translation of Sir Isaac Newton's *Optics* into elegant Latin, a task which he had undertaken at the author's solicitation; who, in return for this favour, complimented him with the sum of £100 for each of his five children.

Being now introduced at court by his friend the Bishop of Norwich, he was appointed by Queen Anne to be one of her chaplains in ordinary; and was soon after presented, at the bishop's request, to the rectory of St James's. Thus exalted to a situation in which he would have to associate with the highest characters in the state, it was thought desirable that he should take the degree of Doctor in Divinity. He repaired for this purpose to Cambridge, where he delivered a thesis on the proposition *Nullum Fidei Christianæ Dogma in S. Scripturis traditum, est rectæ rationi dissentaneum*;—"No article of the Christian Faith, delivered in the Sacred Scriptures, is contrary to right reason." On this occasion, he excited, in all who heard him, feelings of delight and astonishment, which were not soon forgotten, not only by the profound erudition which his thesis displayed, but by the powerful eloquence and classical purity of language, with which he defended it against his able and acute opponent, Dr James, then Regius professor of divinity. A few years after (1712), he gave the world a specimen of his classical taste and erudition, in his splendid folio edition of Cæsar's *Commentaries*, enriched with many judicious notes and corrections, and embellished with some beautiful engravings. Mr Addison, in a just eulogium on this work in the 367th number of the Spectator, considers it as an honour to the English press; necessarily very correct, after passing "through the hands of the most accurate, learned, and judicious writer" of the age; and affording, in the beauty of the paper and the character of the plates, "a true instance of English genius, which, though it does not come the first into any art, generally carries it to greater height than any other country in the world." About the same time, Dr Clarke involved himself in a tedious and unpleasant controversy, by his publication of the *Scripture Doctrine of the Trinity*. Before the appearance of this treatise, her Majesty's ministers, afraid of the agitation which it might produce in the public mind, then but too unsettled, sent a message to request that he would either relinquish his design, or at least delay the publication. But without regarding their application, he proceeded with his work, and submitted his opinion to the examination of the public. Whatever may be thought of his opinions on this important but mysterious subject, he at least deserves credit for the candid and judicious manner in which he conducted his investigation. Aware that it was a doctrine of mere revelation, he did not set himself to invent any ingenious hypothesis, or by metaphysical and abstract reasoning, to support any opinions concerning it already entertained. He had recourse to the scriptures themselves: he explored every text in which mention was made of the three persons, or of any one of them; and accurately examining the words employed, by the best rules of grammar and criticism, he endeavoured to fix plainly what was, and what was not, declared in scripture, respecting Father, Son, and Holy Ghost. His work provoked a number of antagonists, the most able of whom was Dr Waterland, with whom, indeed, our author was at length engaged for some time in single combat. Superior to all his opponents in wielding the weapons of controversy, they resolved to overpower him by a more formidable mode of attack. The Lower House of Convocation made a formal complaint to the bishops, in 1714, of the heterodox opinions and dangerous tendency of his obnoxious work. The bishops, though they applauded the zeal of the inferior house, and requested them to give in extracts from the book in support of their charges, evinced a very becoming spirit of conciliation and peace; and when Dr Clarke, at the instigation of some of his friends, gave in a statement of his opinions respecting the Trinity, they expressed themselves satisfied, and dismissed the complaint. It has been alleged, that in this statement Dr Clarke made a sacrifice of his private opinions to the peace and unity of the church; a sacrifice for which he has been censured or applauded according to the different views and tempers of his biographers. He himself is said to have afterwards regretted his statement, and to have been sensible, when too late, of the error into which he had fallen. It is certain, that to the last he entertained the same sentiments respecting the Trinity which he had avowed in his Scripture Doctrine.

He next engaged in a more amicable and pleasant controversy with the celebrated Leibnitz, on the abstruse metaphysical doctrines of philosophical liberty and necessity. These were points which he had deeply studied, and in the discussion of which he always excelled; but his excellence never shone more conspicuous than on this occasion, when he was pressed by the strength of so powerful an adversary. His papers on these subjects were inscribed to the Princess of Wales, afterwards Queen Caroline, through whose hands they had all passed, and who was the witness and judge of every step of the controversy. He again exposed himself (in 1718) to theological animadversion, and became involved in an unpleasant controversy respecting apostolical and primitive doxologies, by introducing some alterations into the doxologies of the singing psalms, which had been reprinted that year for the use of his church. The alterations consisted in ascribing glory to God *through* Christ, instead of ascribing equal honours to each of the three persons in the Trinity. The bishop of London published, on this occasion, a pastoral letter to the clergy of his diocese, to warn them against innovations, and to forbid them to use the new doxologies. Whiston espoused the cause of his friend Dr Clarke, whose conduct in this affair he accounts one of the most Christian attempts towards somewhat of reformation, on the primitive foot, that he ever ventured upon. He adds, however, that the bishop of London, in the way of *modern authority*, was quite too hard for Dr Clarke, in the way of primitive Christianity. About this time he was presented, by Mr Lechmere, chancellor of the Duchy of Lancaster, to the mastership of Wigstan hospital—a favour which was much enhanced by the handsome manner in which it was conferred. In 1724 he published seventeen sermons on different occasions, eleven of which had never been printed. On the death of Sir Isaac Newton (1727), he was offered the mastership of *the mint*; but as that was a preferment entirely secular, he, with a becoming respect for the dignity of his clerical character, thought proper to decline it. He shewed his gratitude and affection for his deceased friend, by publishing, in the *Philosophical Transactions* (No. 401,) an able vindication of the Newtonian theory on the velocity and force of bodies in motion, in a letter addressed to Mr Benjamin Hoadly. The last great work which he lived to publish was his celebrated edition of the twelve first books of the Iliad of Homer, which made its appearance in the beginning of the year 1729. The value of this work, which comprehended an elegant Latin translation, with a number of admirable notes and illustrations, has been fully recognised and appreciated by the learned in every country, and one whom Clarke himself had characterised, as *Criticos unus omnes longe longeque antecellens*, honoured it with the concise but high encomium, that it was *supra omnem invidiam*. The twelve last books were published in 1732 by his son, who assures us that Dr Clarke had himself finished his annotations on the three first of them, and part of the fourth.

While thus actively and usefully employed, in the full maturity of his intellectual powers, he was seized by a pleuritic affection on the 11th of May 1729, after he had gone to preach before the judges at Sergeants Inn. On the afternoon of that day, the pain abated: His physicians pronounced him out of danger, and his friends were congratulating themselves on the removal of their alarm, when, to their inexpressible surprise and sorrow, the pain shifted from his side to his head, on the Saturday following, (the 17th May,) and terminated that very evening his valuable life. After his death, an "Exposition of the Church Catechism," comprising the substance of a course of lectures which he had delivered in the church of St James's, and which he had carefully revised for the press, was published under the inspection of his brother, who likewise gave to the world a collection of his sermons in ten volumes.

In the bright constellation of genius which adorned what has been called the Augustan age of Britain, no single star, if we except the incomparable Newton, shone with more distinguished lustre than the subject of this memoir. Favoured by nature with uncommon powers of mind, he improved them by almost constant exercise, and enriched them with every thing valuable in literature and science. The knowledge to which ordinary men attain by slow and toilsome steps, he gained as if by intuition; and became eminent in all those great departments of learning, to excel in one of which is accounted no mean praise. As a profound and acute metaphysician, he has rarely been equalled; as a philologist, he has not been excelled; and he who, at the age of 17, could clearly comprehend and duly value the new revelation of the Newtonian philosophy, while yet struggling through the mists of prejudice, must be allowed to have possessed a kindred genius with its immortal discoverer. His chief attention, however, was directed to theology; the sublime doctrines of which became the favourite themes of his penetrating and comprehensive mind, and to the study of which he brought all the aids which human learning can impart. Few men, accordingly, have done more essential service to religion. With regard to his opinions on some difficult points, there will of course be a diversity of sentiment; but no Christian can withhold from him the tribute of admiration and of gratitude for his powerful defence of natural and revealed religion against their most formidable adversaries, and his singular ability and success in forcing these enemies from the strong holds in which they confided most, and in employing their artillery to their own discomfiture. It has been well observed by one of his biographers, that, "from his first

Discourse on the Being of God, to his Letter to Leibnitz on Liberty and Necessity, his writings remain, and will for ever remain, before the world, a lasting monument of a genius which could throw in light where darkness used to reign, and force good sense and plain words into what was almost the privileged place of obscurity and unintelligible sounds." His sermons are addressed, not to the passions, but to the understanding; and on every subject which he treats, his sentiments are so important and judicious, his expressions so nervous and clear, and his mode of explaining the Scripture phraseology so peculiarly happy, as to carry irresistible conviction. His character was as amiable and respectable as his talents were superior and commanding. "His piety was manly and unaffected; his charity and benevolence extensive as the whole rational creation; and the ruling principle of his heart and practice a love of the religious and civil liberties of mankind." In contemplating the life of such a man, we feel a kind of pride in reflecting what the human mind can do, what human nature can be. How few, alas! can enjoy this elevating reflection without a secret pang of self-condemnation for the neglect of their own powers, and the imperfection of their character! See *Biographia Britannica;* Hoadly's *Account of the Life, Writings, and Character of Dr Clarke,* prefixed to his works; Whiston's *Historical Memoirs of the Life of Dr S. Clarke.* (*k*)

CLAVARIA. See CRYPTOGAMIA.

CLAUDIAN, CLAUDIUS CLAUDIANUS, a Latin poet of considerable eminence, flourished in the fourth century, under the reigns of the Emperor Theodosius, and his sons Arcadius and Honorius. The place of his birth is not fully ascertained. He has been represented by various authors, as a native of Florence, of Gaul, of Spain; but the most probable accounts, concurring apparently with his own testimony, assign to Alexandria, in Egypt, the disputed honour of his nativity. He was patronized by the celebrated general Stilicho, through whose influence he rose to considerable dignity and importance. He was made a tribune and notary; and so highly did he stand in the public esteem, that the senate ordered a statue to be erected in honour of him in the forum of Trajan, with an inscription expressive of their respect for his accomplishments and worth. After the disgrace and execution of his patron, he hastily quitted court, and little is known of his subsequent history. Some spurious pieces, inserted among his poems, have given rise to an opinion that he was converted to Christianity; but his own works sufficiently confirm the assertion of Orosius, that he continued an obstinate Pagan to the last. Lardner, however, quotes him as bearing a remarkable testimony to the victory of the Christian emperor Theodosius in Gaul; a victory which was decided in his favour by a storm, so extraordinary in its effects upon the army of his adversaries, as to have been regarded by the poet himself as a visible mark of divine interposition.

Claudian, with all his inequalities, is entitled to a distinguished place among the Latin poets. The classical purity and elegance of his style remind us of the compositions of the Augustan age; and no poet has approached nearer to Virgil, in the dignity and harmony of his versification. His beauties, however, are at least equalled by his faults. His flights, though occasionally bold and lofty, are seldom sustained; and the reader, after his imagination has been fired by the glowing animation of the poet's language, is often cooled, all at once, by his dulness and insipidity. Of his numerous writings, the principal are his satire against Ruffinus and Eutropius, the rivals of his patron Stilicho; his poems in honour of Honorius and Stilicho; his Rape of Proserpine; the commencement of an Epic Poem, which he never concluded; his Idyllia and Epigrams. The best editions of his works, are those of Barthius and Heinsius; Gesner, 1759; and Burman, 1760. For further information concerning Claudian, the reader may consult Suidas, Fabricius, and Tillemont. (*k*)

CLAUDIUS, TIBERIUS CLAUDIUS DRUSUS CÆSAR, the fifth of the Roman emperors, was born at Lyons, about ten years before the birth of Christ. His father, Nero Claudius Drusus, was the second son of Livia, the wife of Augustus; and Antonia, his mother, was the daughter of Antony and Octavia. He was the nephew of Tiberius the brother of Germanicus, and the uncle of Caligula, his predecessor on the imperial throne.

From his earliest years he was subject to a variety of disorders, by which his mental powers were so much impaired, that he became the object of general contempt and ridicule. Deemed incapable of taking any active part in the government of the empire, he was allowed to remain in the condition of a private citizen, till his nephew Caligula was invested with the imperial purple. He was then dignified with the rank of senator, he was made the colleague of the emperor in his first consulship, and presiding occasionally instead of Caligula at the public games, was sometimes greeted by the acclamations of the assembly as the brother of their favourite Germanicus. Even then, however, he was held in general contempt; and in the gross indignities with which he was treated, his life was frequently exposed to imminent danger. From this state of mortifying humiliation, an event, apparently casual, raised him at length to the imperial throne. At the time of Caligula's assassination, Claudius, who was then in the palace, had retired in terror to an adjoining balcony, and concealed himself behind the hangings of a doorway. A soldier named Gratus, while roaming for spoil, observed his feet, and dragged him from his lurking place; but on recognizing his person, he fell on his knees, solicited his pardon, and hailed him as emperor. Affection for the memory of Germanicus soon induced other soldiers to join with Gratus in this expression of regard to his brother; and the new emperor, not yet recovered from his consternation, was conveyed to the camp, and lodged for the night within the ramparts. On the following morning, the soldiers formally proclaimed him emperor, and swore allegiance to him as their lawful sovereign.

The senate, after a few irregular and ineffectual attempts to restore the ancient constitution of the commonwealth, were compelled to submit to the person whom the army had chosen to invest with imperial authority; and had Claudius fallen into proper management, or been left to the free exercise of his own inclinations, they would probably have had no reason to regret their acquiescence. Clemency and moderation marked the first acts of his reign. He published a proclamation of pardon to all who had in any manner opposed his elevation to the throne, or who had been concerned in the late conspiracy against Caligula, with the exception of those only who had been actually engaged in his assassination. He annulled, as too severe and tyrannical, the laws which were then in force against treason; he abolished several oppressive imposts, which his predecessors Tiberius and Caligula had laid upon the people; and the property which they had unlawfully taken from their subjects, he restored to the injured persons themselves if alive, or else to their descendants. These gracious actions were much enhanced by the singular modesty and propriety with which they were performed. The applauses of the people seemed not to elate him, nor would he accept of the honours which the senate had decreed to him as a testimony of their gratitude and attachment. The hopes which these popular proceedings excited, were speedily reversed. Claudius was too feeble and undecided, to sustain long the virtuous and popular conduct with which his reign had commenced. He became a mere tool in the hands of his empress, the infamous Messalina, and of his ambitious and daring freedmen and favourites Pallas, Calistus, and Narcissus. By these artful and wicked confederates, he was kept in constant dread of conspiracies; all the most respectable of his nobles were rendered the objects of his suspicion; and, though naturally inclined to mercy, he became, under their baneful influence, a cruel and oppressive tyrant. Claudius, indeed, was only nominal emperor, while the imperial power was exercised, in all its terrors, by the sanguinary Messalina, and her base associates. Many ladies of the first distinction, among whom was Julia, the niece of the emperor, were put to death at their instigation; and upwards of three hundred Roman knights and senators fell victims to their suspicion and their vengeance. These enormities were often committed even without the knowledge of Claudius, who was equally blind to the licentious conduct of his infamous consort. Her ungovernable passions, however, impelled her at length to her own destruction. She became enamoured of Caius Silius, a young Roman of noble birth, and distinguished beauty; and, with unexampled audacity and infatuation in wickedness, resolved to make him her husband. By holding out to him the most flattering prospects of aggrandisement, and even the hope of elevation to the imperial throne, she induced him to divorce his wife, and to devote himself entirely to her detestable lust.

In relating the celebration of their marriage, which took place during the absence of the emperor at Ostia, Tacitus expresses a kind of fear lest posterity should refuse to credit such an enormity, and therefore takes care to inform us, that he had ascertained the truth from the testimony of some old men, who had been witnesses of these infamous transactions. The simple Claudius was the last to discover his wife's baseness, and his own dishonour; and so much was he the dupe of her artifices, that he seemed willing, even after her marriage with Silius was revealed to him, to receive her again into favour, had not Narcissus, afraid lest his own power should be annihilated by this new union, extorted from him an involuntary consent to her death. After the death of Messalina, the emperor married his own niece Agrippina, who artfully availed herself of the opportunities which her near relationship afforded her, to ingratiate herself into his favour. The abject senate had previously passed a decree to recommend and justify this incestuous union, alike revolting to human nature, and abhorrent from the Roman customs and laws. Agrippina, to secure the popular favour, reversed, as the first act of her power, the sentence of banishment which Messalina had issued against Seneca, and appointed him tutor to her son Domitius. The measures of government, however, soon convinced the Roman people, that they had only exchanged one female tyrant for another. Claudius became as completely the dupe of Agrippina as he had been formerly of Messalina. To secure the sovereignty for her own son Domitius, to the prejudice of Britannicus, the son and legitimate heir of Claudius, was the grand object to which all the efforts of her craft and her influence were directed. Nor was she more scrupulous than her predecessor in the means which she employed to promote her designs. Every person whom she could consider as an obstacle in her way, was speedily removed; and those only were admitted to offices of trust and honour, who were dependent on her favour, and devoted to her will. Her schemes were prosecuted with so little reserve, that they were easily seen through by all, and the emperor was privately apprised of the danger which threatened him. In his first alarm, he uttered some menacing expressions, which came to the ears of Agrippina. She was aware of her precarious situation, and resolved, by strong and speedy measures, to secure the grand object of her ambition beyond the chance of opposition. She therefore took an early opportunity of administering poison to her husband, in a dish of mushrooms, of which he was particularly fond. The poison was effectual, and terminated the life of this contemptible emperor, A.D. 54, in the 64th year of his age, and the 14th of his reign.

The reign of Claudius, though signalized by no warlike achievements of the emperor in person, added somewhat to the extent of the Roman dominion, and the glory of the Roman name. Corbulo and Galba sustained in Germany the reputation of the imperial army, and Plautius advanced the eagle in triumph through some of the finest provinces of Britain. With the view of sharing the honour of his generals' successes, Claudius himself came over into our island, and after witnessing some of the victories of his troops, returned to his capital to adorn his brow with the laurels which the valour of his commanders and their soldiers had earned. Nor was he less ambitious of literary renown, to which his claims were, if not juster, at least less absurd. He composed several works in the Greek and Latin languages; and we are informed by Tacitus, a very competent judge, that his meditated harangues were by no means deficient in elegance. Emulous of the fame of Cadmus and Palamedes, he endeavoured to improve the Roman alphabet by the addition of three letters. Posterity, not aware of the utility of this accession, refused to give it the sanction of custom; though, in the time of Tacitus, the new letters were still to be seen in many of the public edicts which had been issued during the reign of Claudius. He conferred a more essential benefit on his subjects and their posterity, by forming a port at Ostia, at the mouth of the Tiber, for the purpose of providing the city with foreign grain in years of scarcity; by the grand canal, which he cut, with the view of reclaiming, for agriculture, the land inundated by the Fucine lake; and especially by the completion of the stupendous aqueduct, begun by Caius, by means of which the city was supplied with the delightful waters which issued from the neighbouring hills.

On the whole, we cannot contemplate the character of this weak and despicable prince, without joining in the reflection of the judicious historian above-mentioned, that the exaltation of such a man to the imperial throne is to be regarded as an instance of that apparently capricious contingency in human affairs, which frequently mocks all human calculations.—*Mihi quanto plura recentium seu veterum revolvo, tanto magis ludibria rerum mortalium cunctis in negotiis observantur: quippe fama, spe, veneratione potius omnes destinabantur imperio, quam quem futurum principem fortuna in occulto tenebat.* Tacitus, Suetonius, Tillemont, &c. (*k.*)

CLADOSTYLES, a genus of plants of the class Pentandria, and order Digynia. See BOTANY, p. 179; and Humboldt's *Plantæ Æquinoctiales*, p. 202.

CLAY. See AGRICULTURE and ORYCTOGNOSY.

CLAYTONIA, a genus of plants of the class Pentandria, and order Monogynia. See BOTANY, page 154.

CLEMATIS, a genus of plants of the class Polyandria, and order Polygynia. See BOTANY, p. 238.

CLEOME, a genus of plants of the class Tetradynamia, and order Siliquosæ. See BOTANY, p. 263.

CLEONIA, a genus of plants of the class Didynamia, and order Gymnospermia. See BOTANY, p. 246.

CLEOPATRA, a name given to the princesses of the family of the Lagides, as Ptolemy was to the reigning princes. *Anc. Univ. Hist.* ix. 434.

Cleopatra, the daughter of Auletes, was equally celebrated for her beauty, her accomplishments, her profligacy, and her misfortunes. She was the eldest of four children, two of whom were sons, and two daughters, and was left joint heir of the kingdom along with her brother, with whom she was to be joined in marriage, by the direction of her father's will, according to the custom of her family. As young Ptolemy was a minor at the time of his father's death, Pothinus an eunuch, and Achillas commander of the forces, were entrusted with the care of his person and education. These two favourites finding Cleopatra to stand in the way of their views, deprived her most unjustly of that share in the government which she inherited by her father's will, and drove her from the kingdom. Cleopatra retired into Syria, and having raised a considerable army, appeared at the head of it to assert her right to the sovereignty. On the other hand, the young king, with his advisers, took the field, and marched against his sister. The two armies were encamped between Pelusium and Mount Casius, when Pompey, after the fatal battle of Pharsalia, sought an asylum in Egypt, and determined to entrust himself to the prince's party. The fate of this illustrious but unfortunate Roman, and the perfidy of the Egyptians, are well known. In the meantime Cæsar, ignorant of the fate of his adversary, pursued him with all expedition, and arrived at Alexandria just as the news of Pompey's death had reached the city. The people of Alexandria were thrown into a great ferment by the intelligence, and Cæsar had very near paid dearly for his temerity, in venturing himself among them with an inadequate force. As he was prevented from leaving Alexandria, by the Etesian winds which blew during the dog-days, he ordered his forces in Asia Minor to join him. Having gained, however, the affections of the Egyptians by his affable behaviour, he soon found himself free from danger, and attempted to adjust the quarrel between Cleopatra and her brother. His interference was acquiesced in, as Auletes had left the Roman people executors of his will, and Cæsar was at that time invested with the supreme power of dictator. Accordingly advocates were appointed by each party to plead their cause before his tribunal.

Cleopatra, however, knowing that, in affairs of state, policy generally overrules the claims of right, did not wish to commit her cause to Cæsar, though it was acknowledged to be good, till he should be prepossessed in her favour. In full confidence of her charms, therefore, she sought the opportunity of a private interview. It was not easy, however, to obtain this, as the city was chiefly in the possession of the opposite party. She therefore adopted a plan, which she knew would recommend her to Cæsar as a man of gallantry. Taking along with her only one confidential servant, she went on board a small vessel, and arrived under the walls of Alexandria in the dusk of the evening. Here causing herself to be wrapped up in a mattress, she was carried by her servant, as a bale of goods, through the streets of Alexandria into Cæsar's apartment. She was laid down at the dictator's feet, and being unrolled, up started the queen of Egypt in all her charms. Cæsar was delighted with the stratagem; and, as delicacy formed no part in the character of either, they remained together all that night. Next morning Cæsar sent for Ptolemy, and desired him to receive his sister on her own terms. This was by no means acceptable to the prince: and when he was informed that his sister was then, and had been all night, with Cæsar, he left the palace in a violent rage, and running into the streets, he tore the diadem from his head, and cast it on the ground.

The whole city was immediately in an uproar, and the young prince led on the populace to storm the quarters of Cæsar, who narrowly escaped being torn in pieces. Ptolemy, however, was seized by some of Cæsar's soldiers, and the tumult was appeased for a while. Next day Cæsar proposed an accommodation, which promised fair to end the dispute. It was, that Ptolemy and Cleopatra should reign jointly in Egypt, and that Ptolemy the younger son, and Arsinoe the younger daughter, should reign in Cyprus. This proposal was agreeable to all except the party who had expelled Cleopatra, and who foresaw their own destruction in her restoration to power. New tumults were therefore excited, and a bloody war ensued, the particulars of which we shall not detail in this place, as we are only concerned at present with the biography of Cleopatra. The war was terminated by the death of Ptolemy who was drowned in the Nile, Cæsar himself, on one occasion, having nearly shared the same fate.

Cæsar having remained much longer at Alexandria than the situation of his affairs could justify, being fascinated by the charms of Cleopatra, was at last obliged to leave her, by the dangers which were gathering round him. Before his departure, he bestowed the crown of Egypt on Cleopatra, obliging her to marry Ptolemy her younger brother, with a view to gratify the people. This was throwing all the power into her own hands, as Ptolemy was then only eleven years of age. She allowed him to live, so long as he could give her no annoyance; but when he arrived at the age of fourteen, which entitled him, according to the laws of the country, to have a share in the government, she caused him to be poisoned.

Immediately on the murder of Cæsar, she declared for the triumvirs Antony, Lepidus, and Octavius, who had formed a combination avowedly to avenge his death. After the battle of Philippi, which extinguished the hopes of the patriots of Rome, Antony went into Cilicia to settle the affairs of that province. Here he summoned the queen of Egypt to appear before him, on account of some charge which had been advanced against her. She readily obeyed the summons, and set out confident of enslaving her judge. Never had any thing been seen equal to the apparatus of pleasure, with which she approached the devoted Antony, who might fairly date his ruin from that interview. Having provided herself with magnificent presents, vast sums of money, and the most sumptuous dresses, she embarked on board a vessel which was gilt all over, with purple sails and oars plated with silver. She was seated under a canopy of cloth of gold, in the same dress and attitude in which Venus was usually represented, with a number of comely youths fanning her like Cupids, and beautiful virgins representing *Nereids* and *Graces*. The hills re-echoed with the sounds of various instruments, and the oars keeping time with the music, doubled the harmony. Such quantities of valuable spices were burnt on the deck, that the air to a great distance was filled with fragrance.

Antony was at that time sitting in judgment; but his tribunal was instantly deserted, and he was left in the midst of his lictors. The whole city flocked to see this work of enchantment, and flattery mixing itself with the public astonishment, spread the report, that Venus was come on a visit to Bacchus, (designations tolerably characteristic of the parties,) to consult about the welfare of Asia. The triumph of the Egyptian queen was as rapid and as complete as the memorable victory of Cæsar. *She came, saw, and conquered.* The complaints, which had been made against her, were forgotten in the fascinations of her conversation, and the attractions of her person; and Antony drunk the delicious poison, till he neither had power nor inclination to snatch himself from the witchery of her charms. He could deny her nothing, however repugnant it might be to humanity, justice, or religion. *Plut. in Ant.*

At her request, assassins were sent to dispatch her sister Arsinoe, who murdered her in the temple in which she had taken refuge. To preserve Antony within her toils, she kept him in a constant intoxication of various pleasures, to which he had always been prone, though till then he had been capable of great energy and judgment, when roused into activity by the pressure of circumstances. At one of her entertainments, Antony expressing his astonishment at the vast number of golden cups and vessels adorned with jewels, she immediately ordered her servants to carry them all to his house as a present. She wore in her ears two pendants of pearl, the largest that had ever been seen, each of them worth fifty-two thousand pounds of our money. Pliny informs us, that, on a certain occasion, she took one from her ear, and, having dissolved it in vinegar, swallowed it, to show how much she could afford to spend on one draught. She was going to do the same with the other, when Plancus prevented her, and saved the pearl, which was afterwards carried to Rome by Augustus, and, being cut in two, was formed into pendants for the Julian Venus.

One is apt to be astonished at the boundless profusion of this woman, and to wonder that she should make such efforts to please Antony, when her personal charms so readily ensured her conquest. But all this extravagance was not thrown away; she was buying provinces and kingdoms: and the liberality, or rather the madness of Antony, soon reimbursed her for all the wealth she had expended to please him.

Antony being obliged, by the state of his affairs, to leave Tarsus, Cleopatra, having accompanied him as far as Tyre, there took leave of him, and returned into Egypt. But he could no longer exist without her; having therefore entrusted his affairs to his lieutenants, and deserted the plans which he had in view, he followed her forthwith into Egypt, where they spent the winter together in the most disgraceful revelry and dissipation. Whilst Antony was thus wasting his time in folly, Octavianus was daily strengthening his interests in Italy, without any one to oppose him, except Fulvia, the wife of Antony, a woman of masculine spirit, who, notwithstanding her husband's infidelity, exerted herself in securing a powerful party in Rome. Antony found it necessary to attend to his interests in that quarter, and sailed towards Italy with two hundred ships, with the intention of making war on his opponent. His wife met him by the way, but he treated her with the utmost neglect, and instead of commending her zeal, blamed her for exciting unnecessary commotions. His cruelty and infidelity broke her heart: and, on her death, a match was proposed between Antony and Octavia, the sister of Octavianus, with a view to cement the existing differences. Octavia was a woman of extraordinary merit, and Antony's friends entertained the hope that she would completely detach him from Cleopatra, as that connection was universally considered as disgraceful, and was plainly foreseen to be pernicious in its consequences. But having spent a single winter with Octavia at Athens, he hastened back to the scene of his former pleasures, and devoted himself more absolutely than ever to the charms of Cleopatra. As Antony was an excellent officer, he had an ambition common to all the great Roman commanders, of conquering the Parthians. Having made great preparations, he set out for this difficult expedition: but contrary to the advice of all his officers, he sent for Cleopatra to join him in Syria. The delay which her presence occasioned, ensured the failure of an enterprise which, when undertaken by other commanders, even under the most auspicious circumstances, had never proved successful; and Antony's hurry to rejoin Cleopatra, nearly completed the destruction of the Roman army; for he lost sixty thousand men, chiefly by forced marches over the mountains of Armenia, at that time covered with snow.

The fortunes of Antony and Cleopatra, from this period, became so inseparably connected, that their history must be joined, though we should be forced to repeat some circumstances mentioned in a former article of our work. Previously to Antony's setting out a second time against the Parthians, he bestowed on Cleopatra Cyrene, Cyprus, Cœlo-Syria, Sturea, and Phenicia, with a great part of Cilicia and Crete. Having taken Artabazes, King of Armenia, prisoner, contrary to the most solemn oaths and promises, he entered Alexandria in triumph, which gave great offence to the Romans, as they regarded a triumph as peculiar to the city of Rome.

The measure of Antony's follies was now nearly complete: he ordered Cleopatra to assume the name of Isis, whilst he took that of Osiris, and after that they always affected to appear in public in the dress peculiar to these deities.

Octavianus artfully improved all these follies to his own advantage, and the Roman people became at last so exasperated, that he sought only a fair opportunity of declaring war. With this view he sent his sister Octavia to join her husband, intending to make his rejection of her, which he anticipated, the ground of an open quarrel. This produced the effect intended: as soon as Cleopatra heard of her approach, (for she had arrived at Athens on her way to Syria), she affected the utmost despondency, that she might make Antony believe she was dying of love for him. She shed tears, that he might see her distress, and pretended to wipe them away in haste, as if she wished to conceal them and prevent him from being sharer in her pain. These artifices succeeded, and Octavia was ordered back to Rome.

These, with other causes of grievance, completed the rupture between Antony and his rival; and each party now began to prepare vigorously for war. Antony and Cleopatra hastened to Ephesus, where eight hundred vessels were collected to support his cause. His friends now represented the necessity of sending home Cleopatra, to wait the event of the war. But she, afraid of an accommodation between the two rivals, and of her own exclusion from the affections of Antony by the reception of Octavia, used every effort to defeat this measure, and at last succeeded in bribing Canidius, one of Antony's chief advisers, to recommend her continuance with the army. She now became jealous of all his friends, and was constantly employed either in undermining their influence, or in endeavouring to drive them from his presence, by the imperious haughtiness of her manners. In this she succeeded so well, that many of his principal friends, disgusted with her conduct, and afraid for their safety under such dangerous influence, openly went over to the side of Octavianus. This wily politician conducted himself in the whole of this affair with his usual address: finding himself prepared for declaring war, it was proclaimed, not against Antony, but against Cleopatra, as having bewitched him with charms and potions, so as to deprive him of his senses, and make him compromise the dignity of the Roman people.

At last the armies of the two contending parties were drawn up on opposite sides of the Ambracian Gulf: their fleets covered the sea between; and the result of victory was to be the empire of the world. But here the evil genius of Antony finally prevailed: contrary to the advice of his most experienced officers, and contrary to the conviction of his own mind, he listened to the arguments of Cleopatra, who had an eye to her own escape in case of discomfiture, and ventured to commit his fortunes to the issue of a sea fight. The Egyptian queen, who advised the measure, was the chief cause of its failure. She became terrified at the noise of the fight, and fled, with sixty large ships, before she was in the smallest danger. Antony, like a person deprived of reason, immediately followed her, and by his flight decided the fate of the battle, which till that time had been doubtful. He was sensible that he had lost every thing by her misconduct, and for some time refused to see her; but they were soon reconciled by the interference of her maids, and he became her devoted slave as much as ever. Cleopatra, suspecting that her subjects might not receive her, were her disgrace and misfortunes known, entered the harbour of Alexandria with crowns and garlands on the prows of her ships, as if she had been returning from a victory: being thus admitted into the town, she immediately put to death all whom she suspected of disaffection to her person or government.

She now engaged in a very extraordinary enterprize, which perhaps indicated more energy than judgment. Convinced that Octavianus would pursue her into Egypt, and sensible that she possessed no means of resistance, she ordered all her ships to be carried from the Mediterranean into the Red Sea, across the isthmus of Suez, a distance of about seventy miles. Her object was to forsake Egypt, and go in search of some new settlement. The Arabs, however, at the instigation of one of Octavianus's lieutenants, burnt all the ships that were carried over, as well as those that were in the Red Sea before, and the queen was obliged to desist from this romantic undertaking.

Nothing now remained but to await the approach of the conqueror. Antony and Cleopatra sent the most submissive proposals to Octavianus, offering to live a private life at Athens, provided the crown of Egypt were reserved for Cleopatra's children. This proposal was rejected: Cleopatra's ambassadors, however, were instructed by their mistress to treat privately for her own safety: as Octavianus was extremely anxious to get hold of her person, to adorn his triumph, and of her treasures, to defray the expences of the war, he dismissed the ambassadors with many fair words and promises of kind intentions towards their mistress, provided she would kill Antony, who was represented as the cause of all her misfortunes. This she positively refused to do; but engaged to do what amounted to the same thing, to deliver him and her kingdom into the hands of Octavianus.

In conformity with this engagement, Pelusium, the key of Egypt on the east, was delivered into his hands without resistance, though it was capable of sustaining a long siege. Antony was at this time employed on the opposite frontier; and hearing of the rapid approach of the Roman army towards Alexandria, he hastened to the defence of the city. Cleopatra in the meantime, to prevent Antony from suspecting any understanding between her and Octavianus, had retired into a high tower, where she collected her most valuable treasures, and materials for a funeral pile, giving it out, that she intended to consume herself and her treasures together, should the town fall into the hands of the enemy. Antony, with that impetuosity which distinguished him in war, sallied out from the city, and falling unexpectedly on the cavalry of the enemy defeated them with great slaughter.

Encouraged by this success, he prepared next day to engage their fleet; but no sooner was the signal given, than Cleopatra's admiral, in compliance with her orders, went over to the enemy. Antony then hastened to his land forces, but found to his astonishment that they had all to a man deserted to Octavianus. His eyes were now opened to the perfidy of Cleopatra, whom, till that moment, all the remonstrances of his friends could never induce him to suspect, and he flew to her palace in a paroxysm of rage and despair to put her to death. She saved herself by a timely flight, and took refuge with two of her maids in her inaccessible tower.

She now caused it to be given out that she had killed herself, to avoid falling into the hands of the enemy; and Antony believing the tale, instantly passed from the extreme of resentment to that of tenderness, and, in his despair, fell upon his sword, inflicting a wound which occasioned his death.

As soon as Cleopatra heard of this tragical event, all her affection revived for a man whom her counsels had ruined, and at last her perfidy betrayed; and learning that he was not yet quite dead, she ordered him to be raised up to her apartment in the tower, by means of pullies which happened to be there at the time, for the purpose of raising stones to the top of the monument. He was raised with difficulty by herself and her two maids, as she refused to open the gate to receive assistance from below. She received him bathed in blood, and had the melancholy satisfaction of seeing him expire in her arms.

At the moment that Antony breathed his last, Proculeius arrived from the camp of Octavianus, requiring Cleopatra, with many fair promises, to surrender her person. This, however, she obstinately refused to do, except on such terms as Octavianus was determined not to grant; for his great ambition was to have such a celebrated personage to adorn his triumph, whilst she viewed this consummation of her sufferings with the greatest horror. To prevent her from taking any desperate step, Octavianus sent Cornelius Gallus, a man of great honour and eloquence, to converse with her. Whilst he was amusing her with fair speeches at the gate of the monument, Proculeius with two servants scaled the wall, and hastened down to secure her person. As soon as she saw herself within their power, she drew a dagger, which she always carried about her, and attempted to stab herself. But Proculeius springing forward, seized her in his arms, and wrested the dagger from her hands.

Octavianus was overjoyed at this acquisition. He ordered her to be watched with the strictest care, and at the same time to be treated with the greatest respect. He sent to her to know, if there was any favour which she had to ask. All that she requested was, that she might be permitted to bury Antony. This was readily granted;

and Antony's body was deposited, with every circumstance of funeral magnificence, in the burying-place of the kings of Egypt. Her grief and her exertions on this occasion brought on a fever, and, with the consent of her physicians, she resolved to abstain from food, and starve herself to death. This design being discovered, she was placed under the care of other physicians, and was induced by threats and promises to follow their prescriptions.

After she was pretty well recovered, Octavianus sent to her, requesting an interview. She was delighted with this proposal, and prepared to play off all her arts, and all her charms, against her conqueror. But the cold-blooded politician, though he was afterwards sufficiently notorious for his gallantries, had at present a different game to play; he therefore kept his eyes fixed upon the ground during the whole conversation, and it was perhaps not the least of Cleopatra's mortifications, that she had now probably for the first time fruitlessly displayed her charms. She still, however, entertained the hopes, that she might avoid the ignominy of being led in triumph: and with this view offered to give up all her moveables, treasures, and jewels; but Octavianus was determined that nothing should redeem her from this dreaded humiliation. But Cleopatra had succeeded better with Cornelius Dollabella, one of Octavianus's intimate friends. This Roman was desperately in love with her; and had engaged to give her timely intimation of his master's intentions: Accordingly he sent her word, that in three days she and her children were to be put on board a vessel, and conveyed to Rome. This determined her to put in execution the purpose which she had long formed, in contemplation of this event.

Finding it difficult to elude the vigilance of Epaphroditus, who was appointed to watch her, she made a great entertainment, affected unusual gaiety, and in the midst of the general mirth, rose from table, and wrote a letter to Octavianus, which she requested Epaphroditus to deliver into his own hands, as it contained matters of importance. As soon as he was gone, she withdrew with two of her maids, and calling for a basket of figs, which one of her servants had brought in the disguise of a peasant, she applied to her arm an asp which was purposely concealed among the figs. This is the common account; but Plutarch, *in Anton.* says, that she had collected the poison beforehand, and introduced it into her arm, by tearing her flesh with her teeth. She soon expired, in the arms of her maids. In her letter to Octavianus, she requested to be buried in the same tomb with Antony: this leading him to suspect her intentions, he instantly dispatched some of his friends to prevent her attempt. They found her lying dead, on a golden bed, in her royal robes, with one of her maids likewise dead, and the other expiring beside her.

Thus ended the life of this celebrated queen, whose adventures are more like the fictions of romance, than the ordinary details of history. In her ended the line of Ptolemy Lagus, the founder of the Greek dynasty in Egypt, whose family had reigned from the death of Alexander, till its extinction in Cleopatra, 294 years. It is agreed on all hands, that she was very beautiful, very accomplished, and very unprincipled. Chastity was not a virtue that she aspired to, and her libertinism was too much even for an age, in which more than an ordinary degree of profligacy was readily tolerated. And yet she generally bestowed her heart, where she surrendered her person, and continued to retain a tenderness for those who had once been the objects of her affection. Wonderful things are told of her acquirements in point of language; and it is affirmed that she could converse with Ethiopians, Troglodytes, Jews, Arabians, Cyrians, Medes, and Persians, without an interpreter, and with as much ease, as if she had been a native of the countries whose language she adopted. Her death was a great disappointment to Octavianus, who caused her image to be led in triumph, since he could not obtain her person. Horace celebrates her death as a great piece of heroism.

Ausa et jacentem visere regiam
Vultu sereno fortis, et asperas
Tractare serpentes, ut atrum
Corpore combiberet venenum,
Deliberata morte ferocior;
Sævis Liburnis scilicet invidens
Privata deduci superbo
Non humilis mulier triumpho.

Hor. Carm. lib. i. Od. 37.

(g)

CLEPSYDRA. See Hydrodynamics.

CLERMONT Ferrand, *Augustonemetum* and *Arverni Claramons*, a city of France, and capital of the department of the Puy-de-Dome, is situated on a small eminence, at the foot of a lofty mountain between two small rivers, one of which is called the Artier. The streets are narrow, and the houses gloomy, but the promenades and public places are superb. Before the great altar of the cathedral there is a fine ancient sarcophagus. The principal articles of manufacture in this city are, fine rateens, coarse serges, druggets, linen cloth, ribbands, silk stockings, candles, and paper. The preserved apricots of Clermont have been long celebrated; the cheese made in the neighbourhood, known by the name of the cheese of Auvergne, is reckoned particularly excellent. Within an enclosure in the city, there is a petrifying spring, which has deposited across a garden, in the direction of its course, a wall 140 feet long, and in some places from 15 to 20 feet high. This brook is also said to have petrified a wooden bridge so completely, that carriages can pass over it. The town of Montferrand, from which Clermont receives the addition to its name, forms one of the fauxbourgs of the city. Population 24,478. In the *Almanac du Commerce* for 1811, it is stated at 30,000. East Long. 3° 5′ 17″, North Lat. 45° 46′ 44.″ (w)

CLERODENDRUM, a genus of plants of the class Didynamia, and order Angiospermia. See Botany, p. 255.

CLETHRA, a genus of plants of the class Decandria, and order Monogynia. See Botany, p. 211.

CLEVES, the *Clivia* of the ancients, is a town of France, in the department of the Roer, and formerly was the capital of a duchy of the same name, in the circle of Westphalia. It is situated on the brow of a hill, upon the canal of Spoy, about two miles from its communication with the Rhine. The town, which consists of several irregular streets, is divided into the higher and the lower, is well built, and contains about 800 houses. It is surrounded with walls, but is not strongly fortified. There is here a church and three convents. The Lutherans, the Calvinists, and Memnonites, have likewise each a church, and the Jews have a synagogue. In the higher part of the town is an ancient castle, called the *Tour du Cygne*, which, as the inhabitants pretend, was built about 300 years before Christ, and from the top of which 24 towns can be seen. The declivity of the eminence on which it stands, is cut into terraces and walls so as to form a delightful English garden. The principal manufactures of the place are silk stuffs, draps, linen cloths, and tobacco. Population 4243. East Long. 6° 7′ 6″, and North Lat. 51° 47′ 40″. (w)

CLEVES and Berg, Grand Duchy of, is the name of a new grand duchy, formed out of the old duchy of

Cleves, another part of which is added to the French empire, and is comprehended in the department of the Roer.

The Grand Duchy of Cleves and Berg is divided into four departments, as follows:

Departments.	Principal towns.	Population.
Of the Rhine,	Dusseldorff, ...	322,284
Of the Sieg, .	Dillembourg, ...	133,070
Of the Rurh,	Dortmund, ...	212,602
Of the Ems, .	Munster, ...	210,201
	Total population	878,157

The principal productions of the duchy are wood, lint, grain, and fruits of all kinds, cattle, and mines of coal, iron, lead, mercury, copper, and calamine. Napoleon Louis, born 11th October 1804, is Grand Duke of Cleves and Berg. See Roer. (*)

CLIBADIUM, a genus of plants of the class Monœcia, and order Pentandria. See Botany, p. 324.

CLIFFORTIA, a genus of plants of the class Diœcia, and order Polyandria. See Botany, p. 338.

CLIFTON. See Bristol, vol. iv. p. 559.

CLIMATE. See Geography and Meteorology.

CLINOPODIUM, a genus of plants of the class Didynamia, and order Gymnospermia. See Botany, p. 247.

CLINTON. See New York.

CLITORIA, a genus of plants of the class Diadelphia, and order Decandria. See Botany, p. 283.

CLOCK. See Horology.

CLOISTER. See Monastery.

CLODIUS. See Cicero, vol. vi. p. 469.

CLONMACNOISE. See King's-County.

CLONMELL, a market and post town of Ireland, in the county of Tipperary. It is situated at the extremity of the county, on the banks of the river Suire, which is navigable up to the town for large boats, and the tide flows a little above Clonmell. The principal public buildings are the court-house and the jail; the former, in which the assizes are held, is a new and handsome building, and the latter has also been recently built upon Mr Howard's plan. The woollen and cotton manufactures formerly flourished in this place, but they have now greatly declined. There is here an immense establishment for pickling bacon. No fewer than 1200 hogs are annually slaughtered and cured with Liverpool salt. The warehouse, which will hold 100 tons, is paved with flags, and has kennels which convey the pickle into a cistern in its centre. The introduction of the English breed has been found highly advantageous, as it produces much less offal, which brings only one guinea per cwt. The bacon is not dried here, but is sent to England in a pickled state, packed up in cloths. Clonmell carries on a very considerable import trade for the supply of the interior parts of the county. The principal exports are corn and pork. There are two bankers in Clonmell, who circulate notes to the amount of £200,000. The catholics have here a chapel, school, and friary, the ground rent of which Mr Bagwell remits, besides a large poorhouse to which £500 is annually contributed by the county. The burgh is a close corporation under the influence of Mr Bagwell. West Long. 7° 43′, North Lat. 52° 21′. See Wakefield's *Statistical and Political Account of Ireland.* (*w*)

CLOSE *Intervals*, in music or close harmony, are such notes in a chord as lie near to each other. Dr Robert Smith, in his *Harmonics*, prop. 22. cor. 4. says, that "the harmony of a concert will be smoother and distincter, and generally more pleasing, for taking the chords of the thorough bass as near as can be to the bass notes, and no more of them than are necessary, and those few upon the softer and simpler stops of an organ of the common construction; because the beats will then be fewer, slower, and softer, and so the voices and other instruments will appear to greater advantage." On the other hand, Dr Burney says, that "organists have long observed, that close intervals in the bass, though consonant, are disagreeable, and never, in full playing, give the third in a common chord, with the left hand on the bass." Mr Holden, speaking of the minor common chord, *Essay*, p. 124. says, that the third had better not to be hard at all, but the chord be given thus, $\begin{matrix}\mathrm{XVII}\\ \mathrm{V}\\ \mathrm{VIII}\\ \mathrm{I}\end{matrix}$.

The principles on which this gentleman reasons, are, however, some of them so erroneous, as will appear in our article Grave *Harmonics*, that little reliance can be placed on his opinion, towards deciding between the opinions of Dr Smith and Dr Burney respecting close intervals. (*c*)

CLOTAIRE. See France.

CLOTH MANUFACTURE.

Cloth is a term in the English language, particularly applied to the woollen manufacture; but in its more comprehensive and general acceptation, it may be understood to signify any substance produced by the interweaving of animal or vegetable filaments. The cloth made in the islands of the South Sea, from the descriptions of Captain Cook and other circumnavigators, and from the specimens which have been brought to Europe, appears indeed, in general, to be produced rather by cohesion of the parts than texture; but this assimilates it more to the ideas which we attach to paper or pasteboard, than to those which we form of cloth. Almost all the cloth which is known or used in Europe, is composed either of the animal substances, wool and silk, or of the vegetables, flax and cotton. For some purposes, indeed, hair is spun into thread, and woven into cloth; and the finer and more ductile metals, gold and silver, are also occasionally spun along with silk, for some of the richer species of ornamental texture.

History of weaving.

With the antiquity of weaving we are neither much acquainted, nor, however amusing such knowledge might be to the antiquarian, is this loss greatly to be regretted. That the art was brought to considerable perfection in very early ages, is sufficiently obvious, both from sacred and profane history. There seems also little doubt that it is of Asiatic origin, and has only gradually extended to the western parts of Europe. We have the authority of Julius Cæsar, that, when he invaded Britain, it was totally unknown; and the many public acts relative to the woollen manufacture in the earlier period of English history, evidently prove, that the greater part of our wool was, for a very long series of years, exported in a raw state, and manufactured upon the continent. The cruelties and atrocities of the Duke of Alva, in 1567, and the subsequent persecutions attendant on the revocation of the edict of Nantz by Louis XIV. are assigned, by historians, as the causes which gave to Britain the knowledge and ingenuity of foreign artizans, and permanently founded the woollen and linen manufactures, the former of which has become the acknowledged staple of England, and the latter of Ireland. The much more recent invention of Sir Richard Arkwright, has introduced the very extensive manufacture of cotton, and added a lucrative and elegant branch of traffic, the lighter and fanciful department of which has become, in some measure, the staple manufacture of Scotland, whilst the more substantial and durable fabrics have added to England a manufacture, inferior, in importance and extent, only to the woollen.

The process of manufacture of all these descriptions of cloth, from the raw to the finished or marketable state, may be divided into three great stages of manufacture.

1st, The preparatory processes which the raw material undergoes to bring it into that state in which it is fit to assume the appearance of cloth, or what is generally understood by the term *yarn*. For the account which we have to lay before our readers of these operations, we must refer them to the respective articles COTTON, FLAX, SPINNING, WOOL, SILK, &c.

2d, The operations by which the materials are brought from the state of yarn into that of cloth, which is properly the subject of this article, but which we can here only treat in a general way; for the different kinds are so numerous and varied, that we must refer much of the peculiarities to the articles which will be found under the respective titles or names, by which various kinds of cloths or stuffs are known.

3d, The processes which cloth undergoes, after coming out of the weavers hands, to fit it for the market; and which we must also refer to the various articles BLEACHING, DYEING, PRINTING, CALENDER, GLAZING, and many others.

In general, we may remark, that the great requisites in every species of cloth, from the heaviest to the lightest fabrics, are durability, warmth, and beauty. For those kinds which compose the household furniture and dress of the generality of mankind, the first and second are the most essential; and for the ornamental kinds, which furnish show and splendour to the drapery of the opulent and luxurious, the latter is almost the only quality ever required.

On the fabric of cloth.

Previous to entering into any detail of other particulars, we shall lay before our readers such general remarks as occur upon what is termed the *fabric* of cloth; a matter which we conceive to be not only of the most essential importance, but which has been most unaccountably neglected, even by those who practise the manufacture, and who, with very few exceptions, regulate their operations in this respect by no fixed or determinate rule, but generally are contented merely to copy what they are taught, without any other guide to detect error, than actual experience, which very frequently is dearly purchased. Yet we conceive it possible, that this important point may be reduced to such a degree of mathematical precision, as might render it capable of conclusive demonstration, or at least that the approximation may be so near, as to guard the person who will be at pains to adopt it, from almost the slightest danger of great error, even in regulating the fabric of any species of cloth to which he has not been previously accustomed. For the better understanding of this method, it may be necessary to consider, very briefly, that quality of yarn, which is called its *grist* or fineness.

If a thread of yarn be considered as a cylinder, its weight must be in the compound ratio of its magnitude and density. Now, yarn being made up in hanks of a determinate length, this length may be considered as the altitude of the cylinder, and consequently its *grist* or fineness is the area of the base; and then as the areas of cylinders are in proportion to their circumscribing squares, the square root of the square will be equal to the diameter of the base. When yarn of any kind is warped, and stretched in a loom, to undergo the subsequent operation of being woven into cloth, the threads which compose the warp are parallel to each other, and their parallel situation is preserved by the utensil called the *reed*, through the intervals between the divisions of which a certain number of threads pass. The number of divisions in this reed, therefore, ascertains the number of threads of warp which are to be woven into cloth of any determinate breadth. Now the breadth of every thread or cylinder being the diameter of its base, and the reed being the scale which regulates the number of these threads in a given measure, the ratio which the one bears to the other ascertains the number of threads, and their contiguity to each other in the cloth. Let then the square root of the mass in any determinate length of yarn be taken as the measure of the diameter of the base of a thread, and let the number of the reed which will form a proper fabric be known, and any other will be found to form a similar fabric. From this arises a very simple analogy or proportion, which may be thus stated: Let the weight of one kind of yarn be expressed by a, and that of another by b. Let a be properly woven in a reed or scale, which contains 1200 intervals or divisions in 37 inches, which is the common measure of the linen reed. Then to ascertain the proper reed for b, the proportion will be as $\sqrt{a}$ is to 1200 so is $\sqrt{b}$ to the reed required. Hence as a is to 144, so is b to the square of the reed required. Suppose now that a represents cotton yarn No. 60, and b represents No. 100, then

As 60 : 144 : : 100 : 14,400, the root being 15.49 *nearly*, which is the answer. From this the following simple arithmetical proportion will arise for practical use.

1st, If the yarn is known, and the number of the reed wanted,

As the name or designation of the first yarn given
To the square of the given reed,
So is the name or designation of the second yarn
To the square of the reed required.

2d, If, as before, the yarn and reed are known, and the yarn wanted to fit any other reed,

As the square of the given reed
To the yarn,
So is the square of the other reed
To the yarn required.

In actual practice, the following objection, which is very plausible, will readily occur to practical manufacturers, and, at first sight, will probably induce almost the whole of them to reject these rules as erroneous and inconclusive. They will assert, and with truth, that a manufacturer who would implicitly adopt and follow these rules, would either make all his fine goods so dense and heavy in the fabric as to disgust his customers, or that his course goods would be so flimsy in the texture, as to be totally useless. To this it is only necessary to reply, that it arises from no error in the calculation, nor want of truth in the general principle, but in what was premised as a general requisite in cloth at the outset;

namely, that *durability* and thickness is the first object in coarse goods, and beauty and transparency in fine. It would afford but a slender recommendation to a birth-day dress, to possess that warmth and durability which would form the chief excellence of a watch-coat, or blanket; and it would be equally useless, to give to the coarse manufacture, which is valuable in proportion to the shelter which it affords from the inclemency of wind and weather, qualities which could only afford gratification to the eye, by the sacrifice of every comfort.

The warp of a web being longitudinally stretched in parallel straight lines, and the woof or waft being inserted at right angles to it, the substance produced as cloth, will bear a strong analogy to the form of a raft of wood, consisting of two platforms of square beams, laid across each other and fastened together; or if we suppose that a number of cylindrical pieces of wood, such as the topmasts or yards of a ship, are laid parallel to each other, and that cords or ropes are interwoven between them to keep them together, we shall have a very exact representation of a piece of cloth, on a scale of such magnitude as will admit of all the proof of actual measurement. In cloth, even of the finest kinds, the length, breadth, and number of the component threads or cylinders, in the piece, may be ascertained with equal precision; but, from the smallness of the diameter of every thread, it becomes impossible to measure them *actually*, with any degree of accuracy. The length and the weight or mass, however, being known, the diameter may be found by a calculation, which bears evident marks of great exactness, and we may then safely assume that no difference can arise, provided the densities of all threads are the same. Upon this point, however, there has been some difference of opinion, and the subject has been so little investigated in a scientific manner, that it would be perhaps presumptuous to draw any absolute conclusion upon the subject. We shall therefore only observe, that the argument upon which the increase of density in fine yarn above coarse chiefly rests, is this, that in spinning fine yarn, a greater number of revolutions of the wheel are necessary to give the twist sufficiently to produce a sufficient cohesion of the fibres, than in coarse. This is incontrovertibly true; and as the filaments or fibres, by this twisting, assume the form of a screw or spiral, the point to be decided is, simply whether, by this excess of twisting, the fibres of fine yarn are not brought more closely into contact than those of coarse; and consequently that the diameter of the thread is diminished in the same proportion that the twisting is increased. It must be obvious, that where the circumference exposes a small surface, many more revolutions will be required than where it presents a large one, before all the fibres can be sufficiently stretched; and, consequently, that fine yarn will always require more twisting than coarse to give it the same tenacity. But as every thread from the stoutest cable to the finest which human art and industry can produce, contracts *in length*, by the operation of twisting, there seems reason enough to conclude, that the compressing power exerted, acts either entirely upon the length, or that what is exerted on the diameter, must bear a very small proportion indeed to the other. We may therefore infer, that the nearest approximation to actual truth, will be to consider a rope or thread like any other solid cylinder, and that the difference of density will not very materially affect the calculation. Upon this principle we shall easily arrive at a very considerable degree of mathematical precision, and upon the whole come nearer to actual truth, than by any other hypothesis yet known.

In Plate CXCIII. will be found some figures, explanatory of what further remarks may be necessary on this subject as connected with *fabric*; and it will also be useful in conveying correct ideas of the varieties of texture most generally used, both in the substantial and flimsy descriptions of woven goods.

Plate CXCIII. Fig. 1.

Figure 1st of Plate CXCIII. may be supposed to represent any solid body composed of various parts, *lashed* together. If the darkened squares are so many parallel beams of wood, connected by cordage, we arrive at once at a precise idea of texture. The length of these beams is known by measurement; the breadth of the whole consists of the aggregate number of pieces of wood, added to the space which the cords occupy between each, and which will be more or less, in proportion to the thickness or diameter of these cords. It is also obvious, that it is impossible to bring the beams into actual contact; for were we to suppose that the connecting or lashing cords were actually as fine as human hairs, they must still occupy some portion of space. The thickness, it is equally apparent, is that of one beam and one cord; but if we suppose the cords everywhere in actual contact, we may then also suppose that the thickness is that of the beam and two cords. Now, it is hardly possible to conceive, that in a flexible substance, such as those used in the fabrication of cloth, any means could be devised, to bring every thread of woof into actual contact, so as to cover the warp both above and below. We may therefore very safely assume, as a general principle, that the geometrical thickness of cloth, is the measure of the diameter of one thread of the warp, added to the measure of the diameter of one thread of the woof; and that when those measures are equal, the thickness of the cloth is, of course, double the diameter of one of the threads of which it is composed. Thus we have the utmost thickness of fabric of which cloth is capable, and more than even the strongest canvass, with which we are acquainted, can possess. Indeed a fabric of this kind, were it even easily attainable, would be practically useless; for the immense increase of density, would so completely take away every degree of pliancy and flexibility, that the fabric would be as unsuitable for any purpose to which cloth is properly applicable, as a fir plank, or a sheet of copper.

Plate CXCIII. Fig. 2.

In Plate CXCIII. Fig. 2. is a representation of a section of cloth of an open fabric, where the round dots which represent the warp, are placed at a considerable distance from each other. In this figure we see very evidently, that the geometrical thickness of cloth may be considered in the duplicate ratio of the diameter of one thread; for if we suppose the two parallel lines which bound the figure, to represent two boards used in the calender press where the cloth is finished, and that they are to be pressed together by any mechanical power, we shall at once see that their effect must immediately flatten the threads, and divest them of their cylindrical form.

Plate CXCIII. Fig. 3.

Fig. 3. of Plate CXCIII. may be supposed a plain fabric of that description, which approaches the most nearly to any idea we can form of the most dense or close contact of which yarn can be made susceptible. Here the warp is supposed to be so tightly stretched in the loom, as to retain entirely the parallel state without any curve or flexure whatever, and the whole is therefore necessarily given to the woof. This mode of weaving can never really exist; but if the warp be sufficiently strong to bear any tight stretching, and the woof be spun very soft and flexible, something very near it may be produced. This way of making cloth is well fitted for those goods which require to give considerable warmth, but they are sometimes the means of very gross fraud and imposition; for if the warp is made of very slender threads, and the woof of slackly twisted cotton or woollen yarn, where the fibrils of the stuff, being but slightly brought into contact, are rough and oosy, a great appearance of thickness and strength may be given to the eye, when the cloth is absolutely so flimsy, that it may be torn asunder as easily as a sheet of writing paper. Many frauds of this kind are practised. A very common one is in a kind of fanciful stuff which used to be hawked about the streets of London, and most of the large towns of Britain, especially the sea-ports, by a set of men habited like sailors. These stuffs were composed of very fine silk warp, and very slackly twisted cotton woof, perhaps eight or ten times coarser than the warp: the silk of course entirely disappeared, and the semblance of a very strong fabric of cotton was presented, and sold *apparently* cheap, under the pretence of being smuggled home in an East Indiaman. Strength, beauty, and cheapness, were thus apparently united, and the unwary purchaser, whilst enjoying the triple pleasure of having profitably expended his money, procured a desirable acquisition, and outwitted all the precautions which either the government or directors could take, found, to his infinite astonishment and vexation, upon the first application of the finger and thumb, that his purchase, which was generally extolled by the vender, for being *as tough as the mainsail of a seventy-four*, proved as weak as a cob-web. The impostor generally added to the fraud, by pulling the cloth apparently with great force in that direction in which the coarse woof gave the resistance, but cautiously avoided even a touch against the warp, which would at once have detected the fraud.

In Fig. 4. Plate CXCIII. is given a representation of the position of a fabric of cloth in section, as it is in the loom before the warp has been closed upon the woof, which still appears as a straight line. This figure may usefully illustrate the direction and ratio of contraction, which must unavoidably take place in every kind of cloth, in a greater or smaller degree, according to the density of the texture, the dimensions of the threads, and the description of the cloth. Let AB represent one thread of woof completely stretched by the velocity of the shuttle in passing between the threads of warp which are represented by the round dots 1, 2, &c. and those distinguished by 8, 9, &c. When these threads are closed by the operation of the heddles to form the intertexture, the first tendency will be to move in the direction 1 *b*, 2 *b*, &c. for those above, and in that of 8*a*, 9*a*, &c. for those below; but the contraction of AB, by its deviation from a straight to a curved line, in consequence of the compression of the warp threads 1 *b*, 2 *b*, &c. and 1 *a*, 2 *a*, &c. in closing, will produce, by the action of the two powers at right angles to each other, the oblique or diagonal direction denoted by the lines 1, 8—2, 9 to the right, for the threads above; and that expressed by the lines 2, 8—3, 9, &c. to the left, for the threads below. Now, as the whole deviation is produced by the flexure of the thread AB, if A is supposed to be placed at the middle of the cloth, equidistant from the two extremities, or *selviges* as they are called by weavers, the thread at 1 may be supposed to move really in the direction 1 *b*, and all the others to approach to it in the directions represented, whilst those to the left would approach in the same ratio, but the line of approximation would be inverted. By pursuing this plan, which, as far as the writer of this article knows, is totally new, the theory of fabric might be reduced to a very great degree of certainty; and here a field is entirely open for the researches of an expert geometrician, to apply the principles of his science to the most extensive and useful manufacture, not only of this country, but of every other.

Plate CXCIII. Fig. 4.

Fig. 5.

Fig. 5. represents that common fabric used for lawns, muslins, and the middle kind of goods, the excellence of which neither consists in the greatest strength, nor in the greatest transparency. It is entirely a medium between Fig. 2. and Fig. 3. Its principles are in every respect similar to those already noticed.

In the efforts to give great strength and thickness to cloth, it will be obvious, that the common mode of weaving by constant intersection of warp and woof, although it may be perhaps the best which can be devised for the former, presents invincible obstructions to the latter beyond a certain limit. To remedy this, two modes of weaving are in common use, which, while they add to the power of compressing a great quantity of materials in a small compass, possess the additional advantage of affording much facility for adding ornament to the superficies of the fabric. The first of these is double cloth, or two webs woven together, and joined by the operation. This is chiefly used for carpets; and its geometrical principles are entirely the same as those of plain cloth, supposing two webs to be sewed together. A section of the cloth will be found in Fig. 6, Plate CXCIII.; and what further relates to this part of the subject, in the article Carpet.

Plate CXCIII. Fig. 6.

Of the simplest kind of tweeled fabrics, a section is given in Fig. 7, Plate CXCIII.; and as this is a most important branch of the cloth manufacture, it may be proper to consider it with some attention.

Plate CXCIII. Fig. 7.

The great and prominent advantage of the tweeled fabric in point of texture, arises from the facility with which a very great quantity of materials may be put closely together. In the figures, the warp is represented by the dots in the same straight line as in the plain fabrics; but if we consider the direction and ratio of contraction, upon principles similar to those laid down in the explanation given of Fig. 4, Plate CXCIII. we shall readily discover the very different way in which the tweeled fabric is affected.

Thus we see by the Figure, that when the dotted lines are drawn at *a b c d*, their direction of contraction, instead of being upon every second or alternate thread, is only upon every fifth thread, and the natural tendency would consequently be to bring the whole into the form represented by the lines and dotted circles at *a b c d*. In point then of thickness, from the upper to the under superficies, it is evident, that the whole fabric has increased in the ratio of nearly three to one. On the other hand, it will appear, that four threads or cylinders being thus put together in one solid mass, might be supposed only one thread, or like the strands of a rope before it is twisted; but, to remedy this, the thread being shifted every time, the whole forms a body in which much aggregate matter is compressed, but where being less firmly united, the accession of strength acquired by the accumulation of materials, is partially counteracted by the want of equal firmness of junction.

Plate CXCIII. Fig. 4.

The second quality of the tweeled fabric, *susceptibility of receiving ornament*, arises from its capability of being inverted at pleasure, as in Fig. 9, Plate CXCIII. In this figure, we have as before four threads, and one alternately intersected; but here the 4 threads marked 1 and 2, are under the woof, while those marked 3 and 4 are above. As this in no way affects the solidity or strength of the texture, but is merely an auxiliary aid for the addition of ornament, the further discussion of

Plate CXCIII. Fig. 9.

this property will be more appropriately introduced in that part of this article which relates to the ornamental principles of texture.

Plate CXCIII. Fig. 8.

Plate CXCIII. Fig. 8, represents that kind of tweeled work which produces an ornamental effect, and adds even to the strength of a fabric, in so far as accumulation of matter can be considered in that light. The Figure represents a piece of velvet cut in section, and of that kind which, being woven upon a tweeled ground, is known by the name of Genoa velvet; a pretty strong presumption, that the origin of this manufacture at least in Europe is Italian.

That part, however, which produces the ornament, cannot properly be deemed likely to add much to the strength of the fabric, in so far as this is affected by any attempt at divulsion; but where the impulse is by friction, it must contribute very materially to its preservation. Hence, in practical use, velvets of every kind are in great estimation for three very substantial reasons.

1st, Because, by combining a great quantity of material in a small compass, they afford great warmth.

2d, From the great resistance which they oppose to external friction, they are very durable. And,

3d, Because, from the very nature of the texture, they afford the finest means of rich ornamental decoration.

The use of velvet cloths in cold weather, is a sufficient proof of the truth of the first. The manufacture of plush, corduroy, and other stuffs, for the dress of those exposed to the accidents of laborious employment, evinces the second; and the ornamented velvets and Wilton carpeting, are demonstrative of the third of these positions.

In the Figure, the diagonal form, which both the warp and woof of cloth assume, is very apparent from the smallness of the scale. Besides what this adds to the strength of the cloth, the flushed part, which appears interwoven at the darkly shaded intervals 1, 2, &c. forms, when finished, the whole covering, or upper surface. The principle, in so far as regards texture, is entirely the same as any other tweeled fabric, and the more particular discussion must be referred to the particular article.

Plate CXCIII. Fig. 10.

Plate CXCIII. Fig. 10, which represents corduroy, or king's cord, is merely striped velvet. The principle is entirely the same, and the figure itself will sufficiently evince, that the one is merely a copy of the other. The remaining Figures in the Plate, represent those kinds of work, which are of the most flimsy and open description of texture; those in which neither strength, warmth, or durability, are much required, and of which openness and transparency are the chief recommendations. For these reasons, the nature and principle of the texture may be better understood by considering them as mere superficies, than by any section which could be exhibited. The two kinds of gauze and catgut, which form the basis of all the varieties, are still exhibited in section; and the two others, which may be varied almost to infinity, are shown superficially.

Plate CXCIII. Fig. 11.

Plate CXCIII. Fig. 11, represents common gauze, or *linaw*, a substance very much used for various purposes. The essential difference between this description of cloth and all others, consists in the warp being twined or twisted like a rope during the operation of weaving, and hence it bears a considerable analogy to the substance usually known by the name of *lace*. The twining of gauze is not continued in the same direction, but is alternately from right to left, and *vice versa*, between every intersection of the woof. The fabric of gauze is always open, flimsy, and transparent, but, from the twining of the warp, it possesses an uncommon degree of strength and tenacity, in proportion to the quantity of materials which it contains. This quality, together with the transparency of the fabric, renders it peculiarly adapted for ornamental purposes of various kinds, particularly for flowering or figuring, either in the loom, or by the needle. In the warp of gauze, there arises a much greater degree of contraction during the weaving than in any other species of cloth, and this is produced by the twining. The geometrical ratio of this contraction must evidently depend entirely upon the same principle which regulates the contraction of the yarn in spinning, and therefore it is unnecessary to add to what has been already stated upon that subject. By inspecting the Figure, it will be apparent, that the twisting between every intersection of woof amounts precisely to one complete revolution of both threads; hence the following difference exists between this and every other species of weaving, namely, that the same thread of warp is always above the woof, and the contiguous thread is always below.

Plate CXCIII. Fig. 12.

Fig. 12, Plate CXCIII. represents a section of another species of twisted cloth, which is known by the name of catgut, and which differs only from the gauze, by being subjected to a greater degree of twine in weaving; for in place of one revolution between each intersection, a revolution and a half is always given, and thus the warp is alternately above and below, as in other kinds of weaving. The ratio of contraction in this, as in the former, is evidently reducible to the same principles which regulate the spinning.

Plate CXCIII. Fig. 13.

Fig. 13, Plate CXCIII. is a superficial representation of the most simple kind of ornamental net-work produced in the loom. It is called a whip-net by weavers, who use the term *whip* for any substance interwoven in cloth for ornamental purposes, when it is distinct from the ground of the fabric. In this, the difference is merely in the crossing of the warp, for it is very evident that the crossings at 1, 2, 3, 4, and 5, are of different threads from those at 6, 7, 8, and 9. The contraction in weaving this kind of stuff, is vastly greater than any other, and may very easily be ascertained with the utmost geometrical precision, depending entirely on the well understood principles of plane trigonometry; for it will hardly be necessary to take into the account what contraction takes place by the crossing of the threads in a fabric so very open and flimsy. Thus, if the diamond is crossed at 1 by a dotted line, four right angled triangles will be formed, and the contraction of the warp will be in the ratio, which the hypotheuse of each bears to the perpendicular; the former being the longitudinal measure of the warp when stretched in the loom, and the latter that of the cloth in its finished state. This reduces the contraction at once to the Pythagorean proposition, that the two are to each other in the ratio of their respective squares.

Plate CXCIII. Fig. 14.

Fig. 14, Plate CXCIII. represents, superficially, what is called the mail-net, and is merely a combination of common gauze and the whip net in the same fabric. The gauze here being in the same direction as the dotted line in the former Figure, the whole fabric is evidently a continued succession of right angled triangles, of which the woof forms the bases, the gauze part the perpendiculars, and the whip part the hypothenuses. The contraction here being very different, it is necessary that the gauze and whip parts should be stretched upon separate beams.

The above may be regarded rather as hints for the further investigation of the geometrical principles of the cloth manufacture, than as the absolute results of a perfect and matured theory. As nothing has been published upon the subject, the author of this article can only plead its obvious importance, as the motive which has led him to communicate what has occurred to him, as likely to promote a more ample and scientific enquiry.

Plate CXCIII Figs. 15, 16, 17.

We now proceed to state what occurs upon the ornamental principles of texture, referring the reader to Plate CXCIII., Fig. 15, 16, and, 17.

In order to produce ornamental figures upon cloths, it is necessary that the apparatus or mounting of the loom should be properly arranged for the purpose intended, previously to the commencement of the subsequent operations. The rules for this are pretty similar in all the different kinds of ornamental work, and the plans being previously drawn upon design paper, the first operation is to adapt the loom to the design. The designs, or patterns, are included between a certain number of parallel straight lines drawn upon the paper, and intersected by others drawn at right angles to the first. The lines which are drawn from the top to the bottom of the paper may be supposed to represent the warp, and those drawn across, the woof of the web; any number of threads being supposed to be included between every two lines. The paper thus forms a double scale, by which, in the first instance, the size and form of the pattern may be determined with great precision; and the whole subsequent operations of the weaver, both in mounting and working his loom, regulated with certainty and accuracy. To enable the projector of a new pattern to judge properly of its effects, when transferred from the paper to the cloth, it will be essentially necessary that he should bear constantly in his view the comparative scale of magnitude which the design will bear in each, regulating his ideas always by square or superficial measurement. Thus, in the large design, Fig. 16, Plate CXCIII. representing a bird perched upon the branch of a tree, it will be proper, in the *first* place, to count the number of spaces from the point of the bill to the extremity of the tail; and to render this the more easy, it is to be observed that every tenth line is drawn considerably bolder than the others. This number in the design is 135 spaces. Counting again from the stem of the branch, to the upper part of the bird's head, he will find 76 spaces. Between these spaces, therefore, the whole superficial measure of the pattern is contained. By the measure of the paper, this may be easily tried with a pair of compasses, and will be found to be nearly 6$\frac{1}{10}$ inches in length, by 3$\frac{6}{10}$ inches in breadth. Now, if this is to be woven in a reed containing 800 intervals in 37 inches, and if every interval contains five threads, supposed to be contained between every two parallel lines, the length will be 6.24 inches, and the breadth 3.52 inches nearly, so that the figure upon the cloth would be very nearly of the same dimensions as that upon the paper; but if a 1200 reed were used instead of an 800, the dimensions would be proportionally contracted.

Fig. 16.

A correct idea being formed of the design, the weaver may proceed to mount his loom according to the pattern, and this is done by two persons, one of whom takes from the design the instructions necessary for the other to follow in tying his cords. Previously to entering upon this, however, we shall shortly notice Figures 15, 16, and 17, of Plate CXCIII.

Fig. 15.

Fig. 15, Plate CXCIII, is a representation of the most simple species of table linen, which is merely an imitation of checker work of various sizes, and is known in Scotland, where the manufacture is chiefly practised, by the name of Dornock. When a pattern is formed upon tweeled cloth, by reversing the flushing as formerly explained, the two sides of the fabric being dissimilar, one may be supposed to be represented by the black marks, and the other by the part of the plate which is left uncoloured. For such a pattern as this, it is perfectly unnecessary to have recourse to the draw loom, for two sets of common tweel heddles moved in the ordinary way, by a double succession of heddles, are quite sufficient. The other part of Fig. 15, Plate CXCIII. is a design of that intermediate kind of ornamental work which is called diaper, and which partakes partly of the nature of the dornock, and partly of that of the damask and tapestry. The principle upon which all these species of goods are woven is entirely the same, and the only difference is in the extent of the design, and the means by which it is executed, which shall be explained in the subsequent part of this article, which treats of the construction of looms of various kinds. The last, Fig. 17, Plate CXCIII. is a design for a border of a handkerchief or napkin, which may be executed either in the manner of damask, or as the spotting is practised in the lighter fabrics.

Plate CXCIII. Fig. 15.

Fig. 17.

Construction of Looms.

Construction of looms.

The framing of looms is very differently constructed, and it is hardly possible to fix upon any precise or definite rule for practical adoption. The reciprocating motions which are necessary, and the constant recurrence of the percussion necessary to strike home the woof, require great firmness of resistance in the framing, as it is obviously the natural tendency of the reaction produced, to break the threads of warp. Strength, therefore, is not only a desirable, but an indispensible requisite in every machine for weaving cloth. There has been very little attention paid to ascertain, geometrically, the ratio of impulse produced by the operations of weaving, and nearly as little to calculate how the resistance may be most efficaciously and economically presented. In the construction of looms, like every thing else, the ideas of *mass* and *strength* have been confounded, and the loomwright seems most frequently to have supposed, that the usefulness of the utensil, when completed, was to be estimated by the quantity of wood which it contained. Some little attention, to avoid this useless and cumbrous expence, has been lately paid in the manufactories, where the business is conducted upon a large scale; but although these have been found equally efficacious, and much more economical than the former modes, they do not appear to have engaged proper attention, nor to have been scientifically calculated. In the way in which the manufacture of most kinds of cloth is conducted, the loom is very seldom the property of the manufacturer whose goods are woven in it. In general, a loom either belongs to the person who weaves with it, or to some other operative weaver, who lets it at a weekly rent. It is therefore not surprising, that the saving of a few shillings upon a loom, which, if well used, may last for perhaps fifty years or more, will be considered as a matter of very inferior importance to any individual; but were the aggregate of looms employed in the manufacture of cloth in Great Britain and Ireland estimated, the saving which might be effected by proper attention to the principles of their construction, without the smallest prejudice to their utility, would appear an object of great magnitude, even to the national economist.

Plates CXCIV. and CXCV.

Of the looms in use, we shall give a very brief account, referring to Pates CXCIV. and CXCV.

The common weaving loom for plain fabrics is represented in Plate CXCIV. Figs. 3. and 4. It consists of

Common weaving loom.

Plate CXCIV. Fig. 3.

Fig. 3. No. 2.

Fig. 3.

Heddles.

Fig. 4.

The lay.

Plate CXCIV. Fig. 6.

four upright posts, generally about 6 feet in height, and 4 inches by 3 in measure. The sides are made separately, and the two are connected by cross horizontal rails, which may be easily unfixed for the conveniency of removal. Fig. 3. is a horizontal section of the loom, the upper part being taken away, and shews a web as it appears while weaving: A, represents the beam or roller upon which the warp is wound before weaving; B, the lever by which the warp is kept at a proper degree of tension, and which will appear more plainly by referring to Fig. 3. No. 2. which is an elevation. The cord by which it is tightened or slackened, is there represented; and this may be done, almost instantaneously, by shifting the piece of wood C downwards to slacken, or upwards to tighten the warp. This part of the apparatus is only used in dense heavy fabrics, where great tension of the warp is necessary. In the tighter, a weight is used with a cord wound round the beam, which, besides keeping the warp always equally stretched, allows it to yield gently when the woof is struck home. C is the cloth beam or roller for receiving what has been compleated, and presenting a fresh surface to the weaver. In this Figure it is placed below, and receives the cloth after passing over D, which is called the breast beam. In looms for light fabrics, the cloth beam is placed where the breast beam D is represented, and D is entirely omitted. At C is a ratchet wheel, with a catch to resist the force at B, by which the warp is tightened. The yarn of the warp is kept clear by three rods, which pass through it at E. The crossing, by which every thread is kept distinct from all the others, is justly esteemed a point of the first consequence by the weaver, as the entire regularity of his warp depends upon his attention to the accuracy with which he preserves this. At F are the *heddles* or *healds* for raising and sinking the warp to receive the shuttle. In coarse fabrics they consist of two leaves, which rise and sink alternately in plain weaving, and in fine webs four are used. In fanciful weaving they are increased to an immense number, if the pattern be extensive. The lay which contains the reed, and by which the woof is struck home, is represented at G. In Fig. 4. which is a transverse elevation, showing the loom as it appears to a person standing immediately behind the weaver as he is seated at work; the same letters denote the same parts as in Fig. 3. The additional parts which are concealed in Fig. 3. are distinguished by the remaining letters. HH are levers, called jacks, by which the heddles are suspended from a cross rail upon the top of the loom; I is the cover or upper shell of the lay with the reed in it; K represents the cloth as it passes over the breast beam, previously to its being wound upon C, which appears below; at L are two pieces of wood, which are suspended from the heddles. Their use is to connect the heddles with the heddles below; for were the cord taken from the lower shaft of the heddles directly to the heddles, the whole pressure being upon the centre of the shaft, it must either be very strong, or it would yield in the middle. These are called spring staves. The two levers below at M are called marches, and are very useful, especially in ornamental weaving. The heddles appear below at N. By these the warp is opened to receive the shuttle and woof; and these are the principal agents in every kind of ornamental weaving, until they are superseded by the more extensive and complicated apparatus of the draw loom. In the two Figures described, it has been found impossible to give such a representation of the lay or instrument, which acts upon the woof, as would convey an adequate idea of its construction, because in both it was partially concealed by other parts of the loom. This defect is therefore supplied by Fig. 6. which, besides shewing the complete form, gives also an illustration of the manner of acquiring the agency of the fly or flying shuttle, now almost universally adopted in the cotton manufacture; and also one of the ways by which a number of different shuttles may be employed, both for the insertion of woof different in fineness, and also for that different in colour. In this Figure, A represents the cross spar of wood upon which the lay vibrates upon iron gudgeons or centres driven into each extremity, and resting upon the upper rails of the loom which are shewn in section. The suspending parts, which are called the swords, are represented at BB. The underpart of the lay, which is concealed in all the other Figures, appears at C. The boxes for the fly shuttle are visible at D. At E are two pieces of wood, called drivers, which slide upon smoothly polished iron spindles, and which give motion to the shuttle, of which there are two kinds, first, the common shuttle, wrought by the weaver's hand; and the second, the fly shuttle, upon which the drivers act. The drivers are drawn forward by the jerk of the weaver's hand, and the *impetus* must be so suddenly given, as to communicate such a degree of velocity as will lodge the shuttle in the opposite box, before the impelling force is counteracted by the friction of the shuttle on the board which supports it, and its own weight.

As diversity of woof renders a diversity of shuttles necessary, it becomes expedient to shift them rapidly, so that the operation may not be unnecessarily impeded. Many plans have been adopted for this purpose. That represented is perhaps as simple as any, and answers the purpose very well. The three boxes are constructed so as to slide easily up and down in a vertical direction. They are suspended by a cord or wire from the cross levers GG, which move upon centres in the swords or suspensary parts of the lay.

The pin H, being fixed so as to slide freely from right to left on the upper shell of the lay, the levers may be moved at pleasure by the mere shift of the weaver's hand, which works the lay. The driver, if drawn forward, would prevent an obstruction to the shifting of the boxes, but this may be very easily obviated by fixing two small pieces of whalebone, to act as springs, at I. From the ends of those springs, a cord may be carried to the driver, over a small pulley, to draw it back. This part of the machinery should never be used unless where it is indispensible; for the action of the springs, however slight, greatly increases the fatigue of the weaver.

Plate CXCIV. Fig. 5.

When it becomes necessary to employ many leaves of heddles for diversified patterns, the alternate levers, used in plain weaving for shifting the leaves, are no longer fit for the purpose, and the apparatus represented in Plate CXCIV. Fig. 5. becomes necessary. This apparatus, in narrow and light fabrics of cloth, may be constructed with one half of the trouble and expense necessary for broad and heavy work. The most extensive construction has been given for the use of those who find it necessary, and the lighter may be found by merely bisecting the figure vertically, and taking the left hand part. In this case, the heddles must be moved to the middle of the new figure. Instead of the jacks in the former figure, the levers at A are here used, one of which suspends every leaf of the heddles. From the extremities of these levers, a connection is formed, by means of a cord, with the marches at B, of which there are two sets, diverging from the centre of the loom to either extremity. In order that every treddle may operate equally on both sides, the spring-staves CC are used, and from these the connection is formed with the treddles. When a heddle is depressed, this part of the apparatus will raise the leaf or leaves with which it is connected, and by direct communication from the heddles, the sinking is produced.

Such an apparatus as this will form the most comprehensive range of pattern which can be produced, excepting by the draw-loom, which is used when the range of design exceeds what could be produced by leaves and treddles.

Plate CXXX.
Plate CXCIV.

But as the whole machinery of the draw-loom will be found in Plate CXXX. we shall proceed to describe the remaining Figures in Plate CXCIV. to which we have already referred.

Warping mill.

Plate CXCIV. Fig. 1. & 2.

The Figures 1. and 2. represent the construction of a warping mill, which takes the yarn from the bobbin, and disposes it in that form which is proper to constitute the warp of a web. Fig. 1. is a horizontal plan, and Fig. 2. an elevation of this useful and simple machine. From the centre of the mill, the spokes diverge like the radii of a circle to the circumference, as represented at A; and these spokes, being equidistant, serve to measure the warp with great accuracy, and of course ascertain the length of a web. In the Figure, the spokes being supposed to be 11¼ inches asunder, the whole perimeter, or measure of the mill, which contains 16 spokes, is 180 inches, or 4 English ells, of 45 inches each. The mill revolves upon its axis, and may be turned either way, by a rope or band moved by the trundle B, which is turned by the warper's hand. At E is a frame to contain the bobbins, which pass through what is termed the heck, and represented at D. In this heck are a number of finely polished and hard tempered steel pins, each containing a small hole at the upper part, to receive and guide one thread. The heck contains two parts, either of which may be lifted by a small handle below, and the eyes of each are alternately placed. Thus, when one is raised, a vacancy is formed between the threads, and when the other is raised, the vacancy is reversed. By this, the lease is formed at each end of the warp, and this is preserved by the pegs at F and G. These being carefully tied up, give the rule for the weaver to insert his rods. The warping mill is turned each way successively, until a sufficient number of threads are accumulated to form the breadth wanted. The chief part of a warper's duty is to be careful that every thread which may be broken be immediately tied, otherwise deficiences in the warp would occur, highly detrimental, and productive of very great loss of time to the weaver. The box which contains the heck, slides upon an upright post, and winds the warp round the mill in a spiral form, as will be seen in Fig. 2.

Of the common wheel, which is used for winding the yarn upon the bobbins, it has not been deemed necessary to give any figure, because it is very simple, and almost universally known. In the extended state of the cotton manufacture, it appeared, however, desirable, that some more speedy plan should be found than that, whereby a woman's whole time was occupied in winding a single thread upon a bobbin. The first of these machines was therefore constructed about the year 1790; and the writer of this article, who was then very young, had an opportunity of examining its principles, as it was first tried in the works where he received his earliest instructions in that branch of manufacture on which he now writes. Like most other new inventions, it was clumsily constructed, and defective in some material respects. This circumstance, together with that antipathy to improvement of every kind which is the peculiar characteristic of ignorance and obstinacy, created such a prejudice against the machine, that it was thrown aside as a piece of useless lumber. Another machine, different in principle, and constructed at Manchester, was then tried, and abandoned like the former, with the general and conclusive remark, *that they would not do.*

In this state they lay for some years, when a good practical mechanic accidentally discovered them. By a careful examination of that first noticed, he was convinced that the machine might be rendered valuable by a little care, and some slight improvements, which he accordingly executed, and produced a machine in every respect fit for its purpose. They were very soon copied, and the machine is now in general use, with a great saving to those who employ it. Different plans have since that time been devised, one of which is given in Figs. 7. and 8. of Plate CXCIV. the first being the profile, and the second the front of the machine. It consists of two sides, each containing a number of spindles, upon which the bobbins are placed, and the greater part of the moving machinery being in the centre, 50, 60, 80, or 100 bobbins may be driven at the same time, and the whole may easily be attended by two girls, one being stationed at each side.

Plate CXCIV. Fig. 7. & 8.

The large wheel, which puts all the rest in motion, appears at A, and from this first power, two distinct motions are derived. The first of these has for its object the production of the rotatory motion of the bobbin, in which respect the machine is in its principle very similar to those used for the purpose of spinning. The second is merely useful to direct the threads, so that every bobbin of both sets may be regularly and equally filled. The first of these motions is given by a band passing round the rim of the large wheel A, and communicating the motion to a pulley on the axis of the cylinder M, which is formed of hollow plates of tinned iron. From M, every spindle is driven by a small band, working the small pulley or screw on each; or every band, by passing over two screws, may drive two contiguous bobbins. The second motion, which guides the threads, takes its rise from a worm or endless screw B, on the axis of the large wheel A. The worm B turns the wheel C, on the upper end of a vertical shaft; on the bottom of which, a second worm, D, acts upon a wheel fixed upon the axis of a traverse wheel, formed like a heart, upon a principle which will afterwards be fully described, for producing either uniform, accelerated, or retarded motion. If the motion is made uniform, the bobbin will be built in the cylindrical form; but if is is accelerated at each extremity, and retarded in the centre, it will accumulate more yarn in the middle; and the bobbin, when filled, will appear shaped like a barrel. The traverse acts upon a lever, which presses against it at F; and this lever, being fixed to the guides HH, moving upon a common centre, one side is elevated while the other is depressed, and thus every part of the bobbins on both sides are equally or proportionally filled. At I, I, are two cops placed upon skewers, and the guides for the yarn will be seen above. The bobbins are at K, and the thin boards which cover the cylinder and banding appear at L. One of these machines, when properly driven, and carefully attended, will produce as much work as 20 or 30 women can do, if the cops are well built, so as to unwind easily, and without frequent breaking.

Plate CXXX.

In Plate CXXX. will be found three different kinds

Plate CXXX. Fig. 4.

of drawlooms, which are all that are used in Britain, excepting that occasionally employed in the manufacture of fanciful muslins, and the lighter fabrics of silk, which vary so little from the contruction of the damask draw loom, represented by Fig. 4, Plate CXCIII. that a person who is conversant with its construction might almost acquire such a knowledge of the other, even by a single inspection, as would be sufficient to ascertain the difference of their construction, and become entirely competent both to construct and apply it to practice. The draw-loom is used, where the threads of the warp must be raised in such prodigious variety of forms, that no machinery acted upon by distinct levers of any construction could be compressed within the limits of space which it would be possible to allot for their reception. The whole, therefore, consists of a prodigious assemblage of cordage, of which, by a judicious means of affording rapid selection, every individual part may be almost instantaneously set in motion, without confusion or danger of error. Some idea will be found of its construction, by examining the Plate, and by the following brief explanation.

The evident intention of the draw-loom is to combine the means of a very great variety of motion in a very small compass, and therefore that succession of looped threads or twines, which are called heddles or healds in other kinds of weaving, are, in this kind, all separate, and totally independent of each other. Their relative position and contiguity to each other is preserved by a horizontal platform, through which they pass, and which is sometimes a flat board, with a number of perforations placed like the divisions of a diagonal scale; and more frequently a frame of wood, with wires crossed over each other, the intervals between which answer the same purpose. This board or frame is represented at CC. Above this board are placed one, two, or three frames, each containing a number of small pullies. They are represented at B, and their position is that of inclined planes, forming angles of 45° with the horizon, and parallel to each other. All the twines, which compose the harness, pass over these pullies; and the farther extremity of each is fastened to another strong piece of wood, which is represented at E. The other extremity of each twine contains an eye for the warp to pass through, which, for the sake of smoothness and durability, is made of iron, copper, and sometimes glass. Under this is hung a weight to preserve the tension of the line, as represented at D. At a convenient distance between the pulley frame, and the farther extremity or table, another cord or *simple* is attached to each of those composing the horizontal part or tail of the harness, and these descend perpendicularly, and at right angles to the former towards the floor. They are represented at K, the middle set being tight, and in the proper position for working; the other sets slack and laid aside until it becomes necessary for an alteration of pattern to bring them into use, when they are substituted in their turns, and the set which they succeed laid aside. When, in the slack state, they are secured by a clasp of wood to preserve their regularity, and prevent accidents. Parallel to the simples at I is a strong cord with a number of rings upon it, to which smaller cords are tied, which communicate with the simples, and are called *lashes*. Every set of these lashes being selected in rotation, by the connecting cords between each set, they are pulled tight when their action upon the harness is required. The simple, thus pulled, deviates from the straight line, and is consequently contracted in the direct line of distance between its extremities; but every part of the whole apparatus being fast, excepting the lower part of the harness, where the weight is suspended, that part, yielding to the power exerted, rises, whilst the others, upon which no power is exerted, remain stationary, and thus an interval for the shuttle is formed in the warp. The design paper, giving an exact rule for the cording of the lashes, every part is thus raised with regularity and dispatch by the person employed, and the weaver has only to work his heddles as in ordinary weaving.

Plate CXXX. Fig. 4.

Plate CXXX. Fig. 1.

Fig. 1. of Plate CXXX. represents the carpet draw-loom, which, in principle, is entirely similar to the damask, the variations being merely such as to accommodate it to the particular kind of work for which it is designed with greater practical conveniency. The carpet fabric being composed of much coarser stuff than the damask, and containing a much smaller number of threads, there is little difficulty of combining all the changes necessary, without requiring that compression of apparatus indispensible in the damask. The harness and tail part at A, B, C and D are therefore on the same principle. The tail is made fast at E, as before; but the changes being comparatively few, the lashes are tied at once to the tail, and, descend through apertures in the horizontal board F. Each of them has a small wooden handle, like that commonly suspended by an ordinary bell rope, and these being placed in pairs, to correspond with the double fabric of cloth which composes the carpet, they are successively pulled, without any other trouble in selection than that which arises from taking them in regular succession. In the supplementary Figs. 2. and 3. the appearance of the pulley frame is exhibited more distinctly than in either of the other figures. Fig. 2. represents an elevated profile of the working part of the draw-loom, taken from the side remote from that where the harness is wrought; A being the frame work, B the pulley frame, C the perforated board or harness frame, and D the suspended weights. Fig. 3. is a profile elevation of the opposite side; B being, as before, the pulley frame, F the descending lashes, and G the handles or *bobs* by which they are successively pulled. See Carpet.

Fig. 2.

Fig. 3.

The last species of draw loom which we shall notice, is that which is called the patent draw-loom, although whether there is really any actual patent for it in existence or not we have been unable to ascertain. Its object which, however, is very imperfectly attained, is the reduction of labour, by saving that of the child, who is employed to draw the harness, and enabling the weaver, with little loss of time, to effect this operation for himself, independently of the aid of another person. In this respect, its claim to the possession of exclusive privilege seems very questionable were it disputed; for it is a very simple and obvious extension of the principle of the common diaper harness loom, which has been known and used for very many years, and, like the common draw-loom, is an invention which did not originate in Britain, nor probably even in Europe. The harness part of the patent draw-loom, instead of passing through a frame or frames of pullies, has its tail attached perpendicularly to the roof of the shop, immediately above the harness. The simples are brought from it in a horizontal direction, and their extremities fastened above the weaver's head, but at some distance behind. The lashes, therefore, descend perpendicularly, and are kept in regular order upon a cord. When they are tightened, the tail of the harness is therefore brought forward, and each cord of the tail has a knot tied upon it. An instrument called a comb, from its resemblance to one, is also suspended horizontally upon centres, and moves upon a fulcrum like a lever, the teeth of the comb being at a very small distance before the knots on the tail, and inclined upwards in a curve like the teeth of a rake. When the simples are tightened, which the weaver does with his left hand, those cords of the tail to which they are attached are pulled forward, and lodged between the teeth of the comb. The other extremity of the lever being then pulled down, the teeth rise, and by taking hold of the knots, lift all those cords in the tail which are between the teeth. The lower end of the comb lever is secured by a knot on the cord slipping into a notch, and secured there until it becomes necessary to relieve those cords, and pull up a fresh set, which is done by lowering the comb, and proceeding as before. The comb is the only point in which this apparatus deviates in the least from the old diaper mounting.

From the strength of the stuff, whether linen or woollen, of which damasks and carpets are woven, this seems to open an admirable and extensive field for the application of weaving by power. The writer of this article has turned his attention much to the subject, and is confident that the object in view could be very easily effected by an apparatus somewhat similar in principle to what he has successfully employed in another branch of the manufacture, and which he is only prevented from detailing by the length to which this extensive article has unavoidably led him. For the woollen, which requires no dressing, and is strong and heavy in the fabric, it is peculiarly adapted. The reference letters are as follow: (This Figure is given at the bottom of one of the Plates of CROSS TEXTURE.) A, distinguishes the upper rail or cape of the loom, which is shewn in profile; B is the roller or beam upon which the warp C is stretched; D is the perforated board or frame which regulates the cords of the harness; E is the front mounting or heddles, which the weaver works by his feet, and the eyes of which, being somewhat longer than the whole aperture of the warp which receives the shuttle, raises a part of what is above, by the harness, and sinks a part of what is below, thus forming the reversed flushing upon the upper and under parts of the fabric, as will appear by the crossings of the warp threads, and which arrangement is common to every species of harness work, of whatever description; F is the lever which contains the comb, and which is operated upon by the cord and handle G. The beam which receives the cloth when the operation is completed, is represented at H. All the varieties of fanciful weaving are founded upon principles similar to the above. The mode and apparatus necessary for opening the warp may be varied to infinity, and it would be impossible to enter into the detail necessary for every individual part. This exposition of some of the most complicated operations, however, includes most of the general principles upon which the construction of looms depends.

Construction of power looms. PLATE CXCV.

The last subject connected with the construction of looms which we can introduce, is the application of mechanical power to the operations of weaving, which is still in an infant and imperfect state. Such elucidation as we can give of this part of the subject, will be more perspicuous, both to the common and professional reader, by referring him to Plate CXCV.

Wiper loom. PLATE CXCV. Fig. 1.

In this Plate, Fig. 1. represents the profile elevation of that kind of power loom, which was first used in Scotland at the Milntown printfield in Dumbartonshire, and which was introduced by the late Mr Robert Miller, who took a patent for its use, which, we believe, is not yet expired, although looms of this description, whether strictly within the range of the patent or not we do not pretend to ascertain, have been used in various parts of the country. The motions of this, and all power looms, may be reduced to three, viz.

1st, That which, by operating on the heddles, opens the warp to receive the shuttle which inserts the woof.

2d, That which generates the oscillatory motion of the lay and reed, for striking home the woof after insertion, to form the texture.

3d, The alternate motion by which the woof is inserted, by successively driving the shuttle from one side of the web to the other, whilst the warp remains open.

Besides these three principal motions, a fourth is used, by which the cloth is gradually wound upon the receiving beam, and fresh warp presented, without impeding the progress of the other operations of the loom.

The whole of these operations take their primary impetus from the revolution of an iron horizontal shaft, which extends across the loom, and one end of which appears at A. The impetus for the different motions is taken by either four or six treddles; a horizontal plan of 4 is given in Figure 5. If six are required, they may be added, one being placed on either side of those represented in the Figure. Of the four represented, the motion of the heddles is effected by that in the centre numbered 1, and those of the lay by 2. Those of the shuttle are given by 3 and 4. The whole motions are given by eccentric wheels called wipers, of the geometrical construction of which, as they are applicable to an immense and boundless variety of machinery, we shall take the present opportunity to give a cursory account, referring to Figure 6.

PLATE CXCV. Fig. 5.

Fig. 6.

The mechanical operation of the traverse, or wiper, depends entirely upon the divergence or convergence of the various parts of the rim to or from the centre of motion, and hence it may be assimilated to the mechanical power and effect of the inclined plane, being merely an inclined plane applied to a circle. As in its formation the inclination of the plane may be infinitely varied, it becomes capable of producing every variety of uniform accelerated or retarded motion, and by judicious combination, not only the ratio, but the direction of the motion, may be infinitely varied. It is only with the first of these properties that we have in this article any connection; for in the operations of weaving, uniformity of motion, in as far as it is competent to the purpose, is peculiarly desirable, from the circumstance of its operating with the least possible stress upon the warp, a matter of the first and most indispensible importance. For the construction of an equable and uniform traverse, the following simple practical instructions seem all that are necessary, to render it applicable to weaving by power. Let the circle *a b* be constructed of any convenient dimensions, but the larger the better where there is sufficient room to contain it in its working position, and from the centre draw a great number of radii at equal distances through the circumference, and produce them to the length required. On the outer part of the circle set off a distance on the produced line *c d*, equal to the whole range which the revolution of the wheel on its centre is required to produce upon any body acting by pressure against it. The two diameters at right angles to each other will then be similar to the transverse and conjugate axes of an ellipse. The whole range of motion being thus expressed by the excess of the outer above the inner circle, the whole may be divided either into equal parts for uniform motion, or into such geometrical proportions, as will effect the acceleration or retardation re-

Construction of the traverse, or wiper.

quired. In the Figure, the motion required being uniform, the divisions are equal. The divisions on the radii being joined by oblique lines, the wheel will be completed, and the more numerous the radii are, the nearer will be the approximation to geometrical accuracy. Thus, in the Figure, the whole range of motion is the excess of the line from the centre to *c*, above that from the centre to *b*, and, this being equally divided, the motion must be uniform. Upon this principle, depends the construction of all traverse wheels for the production of motion. The traverse, therefore, at A, being constructed on this principle, it is only necessary further to observe, that if it is made in two separate pieces, one of which would move the treddle 1, and the other the treddle 2, the warp will be regularly and alternately opened by the successive action of these two parts; or if the centre of motion, where the warp is closed, be made at 2, both openings or sheds would be formed by half a revolution of the shaft, and only one treddle would be necessary, for the other would form itself simply, by suspending a weight from the heddle. In the latter case, it would be better to form the range upon the semicircle than the quadrant, which may easily be done.

Fig. 1.

The second necessary motion is that of the lay, which is done by a wheel similar to the former. If the traverse for the heddles operates twice in one revolution of the axis, that of the lay must reciprocate four times; but this is perfectly unnecessary in either. Suppose the traverse at A, Fig. 1, to operate successively on two alternate treddles for the fast motion, and twice on the same treddle for the second, then the effect required will be produced, and this is the usual way. In this plan of power looms, the lay is only brought back by the traverse, and returns by the operation of a weight at D. The shuttle motion may be given, by attaching the driver cords to two treddles, struck alternately by wipers fixed on the axis; or it may be communicated as in the crank loom, Fig. 2, which we shall now describe.

Crank loom.
Plate CXCV.
Fig. 2.

Fig. 7.

Fig. 8.

The crank loom is set in motion by the operation of two transverse shafts, and operates entirely without treddles of any kind. The first shaft, the end of which appears at A, is placed perpendicularly under the heddles, and gives motion to them by a double or alternate crank, the Figure of which is shown by Figure 7. As one revolution of this shaft consequently opens the heddles twice, it is necessary that the lay should operate twice in the same space of time. This, therefore, is effected by a separate shaft with two direct cranks, and which revolves twice in the same space of time that the former undergoes one revolution. The particular forms of the crank, and the wheels which connect them, are so clearly pointed out in the Figure, that it seems unnecessary to go further into detail in the description of this machine, than to explain the other Figure 8, which operates on the cords which gave motion to the shuttle. This double or reciprocating lever is fixed to vibrate upon its centre under the web, and rather in front of the heddles. The cross shafts of the lever at A and B, are alternately struck by projecting pieces of iron fixed on the front shaft, and thus the motion is given alternately, according to the end of the lever which is struck. This may be equally well applied, and frequently is so, to the wiper loom, Fig. 1; for both the time and quantum of motion in each machine is precisely the same.

A third kind of power loom, invented by Mr Johnson, was introduced some time ago by Mr Shirreff of Glasgow, which, from its form, is called the vertical loom, and which possesses, in point of utility and convenience, some essential advantages over either of the above.

This loom is represented in Plates CXCVI. and CXCVII., and its construction will be understood from the following description.

Johnson's vertical loom
Plates CXCVI. and CXCVII.

The vertical position of the web requires that the slaise, or lay, (*i. e.* the frame which carries the reed and shuttle boxes,) should have a vertical reciprocating motion, and it accordingly strikes the reed upwards against the cloth in drawing up the woof. The yarn beam is placed below, and the yarn passes from it first up through the heddles, or harness, and then through the reed. It passes thence to the temples, and upwards to a roller, which serves to direct its motion a little backwards to the cloth-beam, upon which it is wound up by the machine, in proportion as the cloth is formed.

It is obvious, that the healds must act in this loom horizontally, which is done in a very simple manner, whilst the pecking motion (*i. e.* the motion of the shuttle) is produced by means of a very natural contrivance, imitating with great precision the motion of the weaver when working with his fly shuttle. In case any thing occurs to interrupt the motion of the shuttle, that very interruption causes the loom to stop, and prevents all further harm to the yarn.

From this general description of the loom, it is hoped that, by the help of a short reference, the Figures will easily convey a distinct notion of its general construction.

Plate CXCVI.

Plate CXCVI. is a profile elevation of a cast-iron frame containing two of the vertical looms.

Plate CXCVII.

Plate CXCVII. is a front elevation of one of the looms.

The same letter refers to the same part, when they occur, in both Figures.

The pully A A receives its motion by a belt from the mill work, and it moves the loom when a bayonet B connects it with the first axle C *c*.

On the axle C *c* are two cranks, by means of which there is a vertical reciprocating motion communicated to the slaise DEFG, Plate CXCVII.

HI is the reed, and DH, DE, the shuttle boxes.

The slaise is guided in its vertical reciprocating motion by the side posts of the framing, and strikes the reed upwards against the cloth in driving up the woof.

By means of the wheels K, L, motion is communicated from the first axle C *c* to the second axle M *m*, which, by cranks and other contrivances, produces a horizontal motion in the healds NO, and it does this at the same time that it produces the pecking motion, (*i. e.* the motion which drives the shuttle,) by means of the alternate motion of the small vertical axle PR, and its projecting arm QR, which arm gives motion to a fly shuttle by thongs, &c.

ST is the yarn-beam, from which the warp passes upwards through the reed, and the cloth, guided by a roller, passes backwards, and is wound up in proportion as it is formed upon the cloth-beam V W. This is done by means of a ratchet wheeel X worked by the motion of the slaise, but so contrived as not to take off the cloth unless it be sufficiently thick.

Z, a small balance-wheel for regulating the motion.

Duncan's new vibrating loom.

The following is a description of a loom invented by the author of this article, with a view to remedy some of the inconveniences which appeared to him to attach most strongly to the vertical looms of the preceding construction, which he had examined. A model was constructed under his inspection, sufficient to weave a narrow muslin web, which was tried as an experiment, and the pressure of attention attending another important mechanical operation in which he was then engaged, prevented him from bestowing upon it all the attention which might have

Plate CXCV. Figs. 3, 4.

been desirable, previous to its introduction to extensive practice. The experiments made were sufficient to convince him of the efficiency of its construction, and he has no doubt of its practical utility if cautiously and prudently tried, and improved where it might be found practically defective. Its chief recommendations are its extreme simplicity of construction, and its capability of working with very little friction, and consequently both requiring little power to move it, and operating with proportionally little of the stress produced by reaction on the yarn. Fig. 3, is a front, and Fig. 4, a profile elevation of this machine.

The machine consists of two wooden frames, one of which is supported by four posts, and may be made about 30 inches high. The dimensions, in length and breadth, may be similar to those of a common loom. The under frame is distinguished by AB in both Figures. The upper frame is rectangular, and is about six inches shorter than the under one, and has no posts. In the middle of the under frame are two screws, by which the upper frame is supported in centres, and on which it vibrates, so that either side may be alternately elevated and depressed, and thus an inclined plane may be formed either to the right or left. By this inclination of the plane in which the web is placed, the shuttle will run from one side of the web to the other, merely by its own gravity, independent of any external impulse, and thus a very troublesome part of the machinery of a power loom may be totally saved. But as celerity of motion in the shuttle is peculiarly desirable, and as the motion produced by mere gravitation is very slow, where the inclination is small, the velocity of the shuttle may be easily increased to prodigious rapidity, by the addition of a very simple apparatus, which is added to the left side of the Figure 3, exactly the counterpart of this, being also requisite at the right The following short description of the construction of the *lay*, and apparatus connected with it, will render this, it is hoped, very perspicuous. In the original model, the lay was morticed into a cross frame of wood, and run upon four small brass wheels upon the frame; but as a pendulum was found of essential advantage to the regulation of the oscillation, the motion below, upon centres, is a material improvement, both in easiness of motion and regularity. At G is a stout bar of flat iron, firmly screwed to and depending from the centre of motion of the upper frame, so as to vibrate along with it, and to the end of this is appended a ball of lead or other ponderous metal. Across this is the short shaft H, upon which the lay vibrates at the joints I, I. The circular form of the swords of the lay renders them more conveniently adapted for the oscillation, as were the centre shaft *produced*, so as to render the whole lay square or rectangular, it must either be hung at an inconvenient height, or the floor must be hollowed out to admit of the oscillation. When the loom is set in motion, supposing the right side first to descend, the lay will be forced back towards the heddles by the cranked lever R coming in contact with the stop S, and this motion will be effected by the connecting rod T, which may be of strong wire. When the inclined plane is thus formed, the shuttle will descend upon it by its own gravity, and lodge in the opposite box. But if the motion is to be greatly accelerated, an upright lever E, moving on the centre F, may be used, and a spindle and driver added to the box at K, as in common looms. Then, if the short tail of the upright lever at K is suddenly checked, by coming in contact with any stop fixed to the frame work, the upper end of the lever E will be thrown forward, with a velocity proportional to the excess of the length of the upright part of the lever E above the short tail, and will project the driver, and consequently the shuttle, with very great rapidity. The shuttle may be retained in the box until acted upon by the lever, by the pressure of a slight spring in the inside of the box. When the left side of the loom is depressed, and the right side elevated, the lever will fall back by the simple change of its centre of gravity, produced by the oscillation, and the driver will follow by the impetus of the shuttle returning. The back part of the driver ought to be circular, to fit the arc formed by the motion of the impelling lever :—a similar apparatus may be added to the box on the other side. By these simple means all the motions of the lay are produced.

As the heddles do not retain their perpendicularity, but are affected by the vibration of the machine, it is proper that the upper and under shaft should be kept from swinging ; and this may be easily effected by a piece of wire passing through both, and secured by a nut between the shafts at either extremity. They are hung by a cord passing over a small pulley at the upper end of the standard U, which is fixed to the oscillating frame. The motion is given to the heddles by the lever V, which is connected to the front leaf by the joint W. The extremity of the lever requires merely to be fixed to the lower frame, so that it can neither rise nor sink, and this may be sufficiently done by two cords or leather belts. The opening of the warp may be made more or less as these cords approach to, or recede from the centre V. By this simple apparatus the alternate motion of the heddles is produced, for the back leaf requires only a sufficient weight to overbalance the front, and keep the connecting cords which pass over the pullies at U tight, whether ascending or descending. The shifting apparatus for rolling the cloth on the receiving beam L, and unwinding the warp from the beam Y, is also extremely simple, and may be rendered very correct. On the end of the axis of the receiving or cloth beam at O, is an obliquely cut spur wheel, which is wrought by a worm or endless screw at P. Upon the short axis, which carries the worm, is also a small ratchet wheel, which, in this case, is supposed to contain only four divisions or teeth. When the right hand side of the loom is depressed by the vibration, one of the teeth of the ratchet, coming in contact with the upper end of the iron stop Q, which is screwed to the immoveable part of the frame work, moves the tooth one half of the range between that and the next ; and a similar stop may be so adjusted as to complete the motion, when the same side is carried to its greatest elevation. Thus eight crossings of the woof will be inserted by every revolution of the worm, and the number of teeth on the oblique wheel being made proportional to the quantity of woof required upon any determinate measure, as an inch or a yard, this may be obtained by shifting the oblique wheel, and substituting another whose teeth are proportional to the quantity sought. For this reason the wheel O ought not to be rivetted upon the axis, but fixed on an octagon or a square, and secured by a screw and nut, which may be easily removed.

Such is the general outline of the principles of this machine, which seems to possess the advantages of simplicity and easiness of working, in a degree considerably superior to any of the former ; but the oscillatory motion of the whole warp certainly exposes it, in a peculiar degree, to the action of the atmosphere, in so far as that may be injurious to the dressing. Until this part of the process of manufacture be more fully examined and further improved, both in its chemical and mechanical department, every attempt at weaving of cloth by the agency of mechanical power, will be liable to very great difficulty. Of what has been done, it may now be proper to give some account, referring for a general view of the mechanical apparatus to Figs. 9, 10, and 11. of Plate CXCV.

Plate CXCV. Figs. 9, 10, 11.

Machinery for Dressing Warps.

Machinery for dressing warps.

An essential point in every kind of weaving is, that the warp be properly prepared or dressed, and this varies according to the nature of the raw material.

In the woollen manufacture, it is only necessary to have the yarn well scoured, to free it from those impurities which may have been originally in the wool, or which it may have contracted in any of the preparatory processes of carding or spinning. For the purpose of scouring, urine is generally used. After going to the loom, the weaver has no occasion to use any further kind of dressing, and it is only incumbent on him to remove obstructions, such as knots, lumps, snarls, twists, &c. which might prevent the free passage of his warp through the heddles and reed, or which, should they pass, would intercept the woof, or injure the appearance of the fabric.

The silk, like the woollen, requires no dressing material to be employed. It is, however, sometimes considered to be useful for increasing the tenacity of weak stuff of this kind, to brush over it very lightly, and in small quantity, a very thin solution of any of the transparent vegetable gums. Gum arabic is most commonly employed for this purpose, which, however, is rarely necessary.

In flax or linen yarn, the dressing is perhaps the most important and difficult part of the whole duty of the weaver. The substance employed is a vegetable mucilage, generally prepared from flour and water, by the simple operation of boiling them together. It is therefore the same substance as that which bookbinders use for pasting together sheets of paper or pasteboard, excepting that the latter increase the cohesive power of the paste by the addition of a solution of alum, which is omitted by the weaver, probably because the substance would, in that case, require more time and labour in drying than he finds it convenient to bestow. The use of this substance in the weaver's operation, is evidently the same as in that of the bookbinder, namely, to promote cohesion. But when this is effected, he is still liable to a very serious inconveniency, which often impedes him much in the subsequent operation of weaving, and also frequently deteriorates the quality of his cloth, both in point of smoothness of surface and equality of fabric. This inconveniency arises from the effect of the oxygen, or vital part of the atmospherical air, acting too rapidly on the vegetable substance of which his mucilage or dressing is composed; and when this takes place to a great degree, the threads lose so much of their pliancy and elasticity, as proves very detrimental to the form which they must assume in the texture. No remedy has yet been devised for this, although the inconvenience is much a subject of complaint among weavers, especially those of linen or flaxen goods. In order to counteract, as far as he can, this impediment to his work, the shop where a weaver works is almost constantly upon the ground floor of the house, and he dispenses with fire as much as he possibly can, even in the coldest weather, and is only a little more profuse, when in consequence of excessive rains, the moisture, which is most rapidly absorbed by his warp, produces nearly as great an inconvenience as the heat, which he is in general so anxious to avoid. The only two antidotes which have hitherto been tried for these inconveniences are as follow: 1st, By mixing the salt brine or pickle of beef or herrings, in small quantities, with the dressing, in dry hot weather. This produces a beneficial effect to a certain degree; but should the weather change suddenly, the excessive tendency of the saline substance to imbibe moisture, frequently produces more trouble and delay to the weaver, than even the hardness produced by the heat itself. 2dly, By inducing a degree of fermentation in the dressing previously to using it. This is very frequently practised, and found very beneficial; but although it certainly has a considerable tendency to resist the atmosphere, it probably in some measure diminishes the cohesive quality.

It seems probable that this is the plan used in India in the decoction of rice, with which the Indian weavers dress their cotton yarns; and from the heat of the climate in that country, and the little pains they are known to take in order to preclude the action of the air, it is to be wished that we were better acquainted with the peculiar nature of their process. It is also common sometimes to use a little butter milk along with dressing; and this being an animal substance, we are inclined to think might, with a little pains to investigate the proper quantity and best process, be made of considerable use. It might also be proper to make some experiments with the different kinds of animal *glutina* which are most easily obtained. We know that in another part of the process of manufacturing cotton, namely, the dyeing of the colour known by the name of Turkey red, the whole preparatory process consists merely in impregnating the vegetable substance with animal matter. The colour is at length given very easily, merely by boiling the cotton previously prepared in a decoction of madder, which is itself a vegetable substance. The animal substances used are sheep's dung and bullock's blood. We know also that colour is destroyed by the action of oxygen very rapidly; we further know, that the very act of fermentation in a great degree deoxydates the substance upon which it acts. From all these circumstances we may infer, that any substance which will resist the oxygen most effectually, is the substance wanted. From this it appears probable, that some benefit might arise from trials of certain quantities of the weakest kinds of animal jellies; but as we are not aware that this has been attempted, it is hinted at with hesitation. The common weaver would probably be so disgusted with the labour and loss of time, which it would cost him to dry the first dressing with his fan, that these inconveniences would induce him to relinquish the experiment with disgust, as totally impracticable and nugatory. But when the immense importance of supplying this desideratum in a most extensive manufacture is considered, the man of science might find his time less usefully and profitably directed, than in such an investigation.

Whatever advantage might accrue to the manufacture of cloth by chemical improvement, would be of very essential importance in all the larger establishments, where regularity and economy are equally indispensible with proper apparatus. In short, taken in every view, this is the *grand desideratum* both in the linen and cotton manufactures.

We are only acquainted with three attempts to introduce the agency of mechanics for the purpose of dressing the whole warps of webs previous to commencing the operation of weaving; and it may be no injustice to the inventors to state, that we still consider even the mechanical apparatus obviously susceptible of very great improvement.

The first of these machines has been used both in England and in Scotland, in some manufactories, but has not come into general practice. It originated in a large work erected at Stockport in Cheshire; the second was introduced by Mr John Monteith at Pollockshaws; and the third by Mr James Dunlop at Barrowfield, near Glasgow.

Stockport Dressing Machine.

Stockport dressing machine. Plate CXCV. Fig. 9.

In Fig. 9. is a profile elevation of the principal working parts of this machine, which is introduced more because it is the first attempt of the kind, and as an illustration of the first approach to mechanical improvement, than for any real merit or utility which it possesses, as it is evidently both complicated and imperfect in many respects. The frame-work at AA consists of two similar parts, meeting in the centre, where the receiving beam E, which is afterwards to be carried to the loom, is placed. The yarn, in this process, is not warped upon a mill, but certain portions of it are wound from cops or bobbins, upon separate beams or cylinders, which are carried to the dressing machine, where they are placed horizontally at the extremities at CCC; and in this instance six of these (three at either side) are supposed to be combined, for the purpose of forming one warp. From the beams at C, the warp is carried over the two directing pullies at DD, and received on the roller E. The mucilage is placed in a trough placed under the beams, which, being entirely similar in principle to the plan in Fig. 10. is omitted in this part of the Plate. The brushing of the warp is effected by four brushes of a length sufficient to cover the whole breadth of the surface, two of which act above, and two below. They are marked BBBB, and receive their motion by means of a double lever GG, from a crank at F. The shaft is kept always parallel to the horizon, by its connection with the balance-levers on each side of E. The drying part of the operation is effected by the revolution of wooden fanners at H, previous to the warp being received on the beam at E. Before reaching the receiving-beam, the warp passes through a pair of *heddles*, or *healds*, to preserve the lease, and these are kept slack, that they may not break the warp in the passage. When a web is dressed, it is taken to the loom, and another set of heddles, containing the *thrum*, or remainder of a finished web, are substituted, and a new warp being twisted to the thrum, the operation proceeds. A great, and perhaps irreparable defect in this operation, is its immense friction; for, in order to preserve the regularity of the warp, it is divided by a succession of reeds, which is a clumsy and injurious expedient; for the dressing is much rubbed off, and the warp frequently broken by the friction of the reeds, especially when clotted by the mucilage.

Pollockshaws Dressing Machine.

Pollockshaws dressing machine. Plate CXCV. Fig. 10.

To improve this machine, that introduced at Pollockshaws by Mr Monteith was invented, and in some respects it is certainly very superior to the former. It will be seen in Fig. 10. This machine, like the former, consists of two parts, meeting in a common centre, where it is wound upon the beam, from which it is afterwards to be woven. The motion is taken from the moving power by the pulley A upon the same axis, with which is a small bevel-wheel, concealed behind the small circle near the centre. This operating by means of anothe bevel-wheel also concealed, turns the upright iron-spindle B, by which the four brushes are set in motion. The bevel-wheel at B operates upon that at C, and gives motion to two horizontal shafts extending longitudinally along the machine. Those at DD on each end move two cylinders covered as brushes, which operate upon the warp. The beam G contains the yarn previously to its being dressed, and the mucilage is supplied by its revolution in the trough, as represented in the Figure. Another roller may be beneficially placed above it, to rub off any redundant quantity, and return it into the trough. The drying part of the operation is effected by the revolution of the fanners EE upon their own axes; and this motion is taken from the wheel A, by bands passing over the directing-pullies at F. The motions given to the brushes, and those to the fanners, are so contrived, that either may proceed while the other is at rest, so that the warp may be neither too hastily nor too slowly dried. After passing over the directing-rollers at HH, the dressed warp is received below upon a beam concealed by the large wheel A. The warp in this machine is also kept regular by passing through reeds, which is a serious objection to it. In this machine, the brushing is effected in a much neater form than in the former; but the other objections being still unobviated, render it at least problematical, whether it may ultimately be found valuable, unless very much improved.

Barrowfield Dressing Machine.

Barrowfield dressing machine. Plate CXCV. Fig. 11.

The last attempt with which we are acquainted, is that made by Mr Dunlop, at Barrowfield, which combines part of the common operation, and does little more than supersede the labour of fanning by the hand. It is represented by Fig. 11. In this machine, the warp is taken from the beam at B, and received upon that at A after being dressed. Here nothing more than that division of labour, which keeps one man constantly employed in dressing the yarn which is to be woven by another, is attempted. Every part of the operation, viz. *clearing* the warp, *picking* and brushing it, is as much a manual operation as that done in the weaving loom. The warp is in the same way divided by rods, and these are brought down by clearing the warp with a comb, as in common weaving. The brushing being finished, the operator saves merely the labour of fanning, by setting the fanners below in motion by mechanical power, communicated by the band GG. The fanners at C are inclosed in a thin box D, and thus the current of air which in the other machines diverges in every direction, is entirely directed to one part of the warp, escaping through an aperture in the box, represented by the dotted line. This aperture is successively directed upon every part of the warp by the revolution of the traverse-wheel F, which acts by pressure upon the lever E, connected with the lower part of the box by a joint. The rotatory motion may be given to the traverse by the oblique shaft H, which will receive it from the axis of the fanners. The use of the box in this machine seems judiciously to confine the current of air to that line of direction where it is useful. The facility of picking the warp is also of importance; for no machine can ever be made to effect that by physical means, which is the result of the metaphysical operation of the mind. Were the means of brushing by power added, which might be easily done, the attendance of one man would be sufficient for all the picking generally required in three or four machines; and in this case the invention might be rendered as far useful as the defect in the chemical part will admit.

In this cursory detail of the principles of the cloth manufacture, and of the most prominent operations, much must unavoidably be left very imperfectly treated. It may be said as an apology, that, independently of the extent of the subject, and the difficulty of compressing it within any tolerable limits, in a work devoted to general science, sufficient instances have been adduced to evince, that, theoretically, the subject itself as never been properly studied; and that even many of the practical improvements appear to be still in a state of infancy, or at least very far from maturity. (J. D.)

CLOUD. See METEOROLOGY.

CLOVER. See AGRICULTURE *Index.*

CLOVIS. See FRANCE.

CLUNY, a small town of France, situated between two mountains on the Grone, in the department of the Saone and Loire, and is celebrated for its famous abbey, which is now in ruins. Its principal manufactures are woollen and silken stuffs; and it carries on a small commerce in wines, corn, and sheep skins. Population, 3814. (*w*)

CLUPEA. See ANCHOVY and ICHTHYOLOGY.

CLUSIA, a genus of plants of the class Polygamia, and order Monœcia. See BOTANY, p. 345.

CLUYTIA, a genus of plants of the class Diœcia, and order Gynandria. See BOTANY, p. 340.

CLYDE. See LANARKSHIRE and RENFREWSHIRE.

CLYPEOLA, a genus of plants of the class Tetradynamia, and order Siliculosa. See BOTANY, p. 260.

CNECRUM, a genus of plants of the class Triandria, and order Monogynia. See BOTANY, p. 97.

CNEPH. See EGYPT.

CNESTIS, a genus of plants of the class Decandria, and order Pentagynia. See BOTANY, p. 219.

CNICUS, a genus of plants of the class Syngenesia, and order Polygamia Æqualis. See BOTANY, p. 293.

COACH, a covered carriage, moveable on wheels, for the conveyance of passengers. A carriage of pleasure or state, distinguished from a chariot by having seats fronting each other; *Johnson.* Fr. *Coche.* Ita. *Cocchio.* Sp. *Côche.* Bel. *Koetswagen.* Teu. *Kobzen. Kutzsche á verbo Hungarico kotczy, idem, quod in Hungaria hoc curriculi genus primum inventum fuerit.* See *Ductor in Linguas,* by John Minshew.

For the numbers in different countries, the origin, and other particulars, see CARRIAGE.

COACH-BOX, the seat on which the person who drives the coach sits.

COACH, HACKNEY. See CARRIAGE. Hackney coaches are under the controul of the police. In order to prevent imposition, no hackney coachman is entitled to payment of his fare without producing, if required, a set of regulations, printed and issued under the authority of the police magistrate.

Hackney coaches pay duty to government, as other public carriages.

COACH, MAIL. These carriages are under the superintendance of the post office, and are employed chiefly for the purpose of conveying the mails all over the country. One contractor furnishes the whole, and is allowed a certain sum by the post-office for every mile each coach runs. They are also exempted at present from payment of toll duties, and are, alongst with other stage coaches, limited, by act of parliament, in the number of passengers they carry, the height they are to be made from the ground, and in many other particulars, intended for the greater security of travellers.

Mail coaches generally go at the rate ef seven miles an hour, including all stoppages.

COACH-MAKER, the artificer whose trade is to make coaches.

COACH-MAKING.

THE art or (technically) *calling* of coach-making, is the method of constructing and executing all the various parts necessary to, or connected with, any description of carriage used for the conveyance of passengers.

Without entering minutely into the detail of the manufacture of carriages, we shall state the general objects the coach-maker has in view in constructing them, the different branches into which the art is divided, mentioning the materials of which the various parts are composed, with any of the peculiarities in the execution of the work that may be worthy of remark.

As some confusion might arise from using the word carriage, meaning the whole vehicle complete, and *carriage,* as technically undestood by coach-makers, meaning the frame-work upon which the axle trees and springs are fixed, without including either the wheels or body of the machine, it is necessary to state, that, when printed in *Italics,* it is to be understood in the latter sense.

As a carriage is composed of various parts, and as all these parts must exactly correspond with one another, it is absolutely necessary that a working draft of the full size be completed before a carriage can, with propriety, be begun to be made. In the first place, it depends upon the construction of the *carriage,* what difference will be required betwixt the height of the fore and hind wheels to bring the perch to a proper level; the depth, from front to back, of the body, and the height which it is to be hung from the ground, is next required, in order to ascertain the proper length of the *carriage,* (that is) what distance the fore and hind axle trees are to be from one another. The particular manner in which the body is to be hung upon the *carriage* must also be fixed, in order to give the springs a proper degree of curvature. To obtain these particulars, a draft is made of the entire machine, and from it the master coach-maker at once sees what effect will be produced, and alters it until it pleases him: from this draft each workman takes his measures and makes his patterns, by which means every part of the work may be going on at the same time.

In making these drafts, the coach-maker is limited, in a certain degree, by the fashion of the day, at the same time he has it in his power to display his own taste and judgment in the construction; and his objects are to combine elegance with strength, and to obtain such a fitness of one part with another, that the carriage, when finished, shall appear as a whole, not wanting any thing that it ought to have, and not having any thing that it could apparently do without, endeavouring to give as much ease to the body part as possible, not to make any part heavier than absolutely necessary, and particularly to make it easy of draught, by having the best finished axle trees set in such an exact manner that the wheels may run perfectly free, following one another in the same tract.

The different branches of coach-making, as commonly practised, are,

1. Body making.
2. *Carriage* making.
3. Wheel making.
4. Smith's work.
5. Painting.
6. Trimming, and
7. Harness making.

Some of these branches may be subdivided, as in harness making there is included collar making and saddlery. The herald painting is done by workmen of great experience and taste, who do not generally perform any of the coarser work; and *carriage* painting is often done by a class of workmen different from those who paint the body; and in body and *carriage* making, the carving is sometimes done by workmen, who practise that particular department, although frequently by the body and *carriage* makers themselves. The glass frames and inside boxes are generally made by workmen constantly employed in that way, who, in general, also put on the plated or ornamental work, but are considered so nearly allied to the body makers as hardly to form a different branch.

I. *Body Making.*

Body making.

That is, the making the wood work of the body or shell, or that part containing the seat of every vehicle generally known by the name of carriage, whether open or close, and having either two or more wheels. This is considered the nicest branch of the art of coach-making, and very deservedly so; for to understand it thoroughly requires a knowledge of mathematics rarely to be met with in the lower classes, besides an accuracy and delicacy in the junctions of the various parts, and neatness in finishing, which no other part of coach-making so particularly requires. The variety in this branch is also much greater than in any other, as almost every carriage takes its particular name from the shape, size, or construction of the body, without reference to any other part of the vehicle, as for example, Landeau, Landeaulet, Coach, Chariot, Chaise, Phaeton, and Vis-a-vis, all differ only in the body, as all may have the same construction of *carriage*. In the present fashion of carriages, with the body made round or bulged on the sides, there are upwards of sixty frame joints in a chariot body, and scarcely one of them square. To find the exact length of each piece, and precise angle of each joint, (all of them differing from one another,) would require a knowledge of mathematics, not to be expected in ordinary workmen, and which, had they not been reduced to practical rules, would have proved an unsurmountable obstacle to the immense variety now to be seen in our modern carriages. But the principles once having been fixed, and practical rules deduced from them, the mechanic finds it easy to follow and instruct his pupil in the latter, without any knowledge whatever of the former.

The frame-work of the body is uniformly made of ash timber, the bottom (and roof of close carriages) of fir, as being lightest, the pannels of mahogany, (sometimes walnut tree,) as fittest from its nature to receive the paint, and more pliable to take the curved form which is required. The roof is covered with leather; the back and upper quarters are sometimes made of mahogany, but more frequently of fir, and covered with leather also. The joints of the frame-work are all put together with white lead ground in oil, and the junction of the pannels with the frame-work is strengthened by small blocks of wood being glued to both, and strips of canvas glued at small distances from one another across the reed of the wood, all over the inside of the pannels, reaching from the frame-work on the one side to the frame-work on the other. The curvature is given to the pannels by holding to the fire, or to a piece of iron made red hot, the side which is required to be hollow, and by applying water to the opposite side, by which the one side is contracted and the other side is expanded. When brought by this means to the desired form, they are fixed into grooves, or laid down with glue upon the frame-work until dry, and then cleaned off; the door pannels, besides this, are secured with plates of brass, attached firmly to the frame-work by screw nails. The utmost attention should be paid to use the best seasoned wood, as the smallest shrinking of any of the joints, or contraction of any of the pannels after being painted, injures the appearance, although not always materially, the security of the carriage.

II. *Carriage Making.*

Carriage making.

The *carriage*, as understood by coachmakers, is the frame-work which is necessary to support the body or shell of the machine. It in general consists of the perch or cranes which connect the bars upon which the hind and fore springs are fastened, and the other bars behind and before, upon which are fixed the spring-stays, the axles, the foot-board behind, and boot or budget before. Some carriages are now made without perches or cranes, but still the bars necessary for the above purposes are all that are technically called the *carriage*.

This branch is considered next in importance to the body-making, and in fact, in the knowledge of these two may be said to consist the art of coach making, as it is possible for workmen not regularly bred coachmakers to finish all the other parts, as wheels by wheel-makers, trimming by upholsterers, painting by ordinary painters, harness by saddlers, and so on; although there are peculiarities in each of these branches only applicable to coach-making. The *carriage*-maker, although not required to finish his work with that delicacy which is indispensible in the body-maker, has nevertheless to put together his joints with great precision and firmness, as the strength and durability of the whole depends much upon the *carriage*; for it undergoes more fatigue, and is therefore liable to fail sooner than any other part, the wheels only excepted. For this reason, the best seasoned wood must also be made use of in this branch, that none of the joints may shrink. In fitting the various iron plates and stays, great care must be taken that they be properly set to the required curves, and that their bearings be quite correct before being fastened, as otherwise, by the force of the bolts in screwing them on, the wood work would be twisted, and thereby not only disfigure the appearance of the parts, but materially weaken them. Smiths in general are so little aware of this, that the *carriage*-maker has often more difficulty in getting his iron work made perfect, than in executing his own more particular department. The *carriage* is always made of ash of the strongest growth, and perfectly dry; the joints are put together with white lead ground in oil, secured with bolts and iron plates, stays, hoops, and other iron-work, to the weight of from 230lb. in a light carriage to 370lb. in a heavy one, exclusive of axletrees and springs.

In fact, carriages, as they have been made for many years past, are, in every part, a combination of wood and iron, in order to produce a light appearance; the workmen being enabled, from the additional strength of the iron, to reduce the dimensions of the wood. The axle-trees are let into a groove in the underside of their respective bars of wood, (technically called beds) in order to secure steadiness; and they are fastened to the wood by iron hoops and bolts. The springs are made fast to their respective bars with screwed bolts, and the fore or under *carriage*, (that is, the frame work of wood to which the fore wheels are attached,) is secured to the main *carriage* by means of a strong iron bolt, called the perch bolt, upon which the axle of the front wheels turns independently of the hind wheels, thereby enabling the whole *carriage* to turn with ease, which it could not otherwise do.

III. *Wheel Making.*

Wheel making.

A carriage wheel consists of the nave, the spokes, and the rim. The nave is the centre wooden part of the wheel, which is turned in a turning lath, according to the taste of the workman; and into mortices in this, the spokes are driven which connect it with the rim. The rim is composed of several circular pieces of wood, called felloes, which are bored with holes to admit the outward ends of the spokes; the spokes being inserted in these holes, and wedged up, and the joinings of the felloes secured from passing one another, by internal connecting pins, called dowels, the wood work of the wheel is completed.

To secure the nave from splitting, two iron hoops are put round it; a narrow one at the end having the greatest diameter, which goes next to the carriage, and is called the in-head of the nave; and a broad hoop is put round the smaller end farthest from the carriage; this end is called the out-head of the nave; and the hoop, last mentioned, projects beyond the nave, in order to protect the end of the axletree of the carriage when running, and in the fore wheels it also serves the coach-man as a footstep to mount to the driving box or seat.

The chief difficulty in this branch is the execution of the work, as the angles of the joints are easily found, after which it only remains to draw a circle of the given diameter of the wheel, and work the felloes to it. When the workman, therefore, by experience, is enabled to put his work together in such a way, that, when the wheel is completed, all its parts bear equally against one another, the knowledge of his art is acquired; and, being provided with wood of good quality and well seasoned, he will produce a wheel of strength and durability. The naves are generally made of Scotch Elm, the spokes of Oak, the main stem of small Scotch Highland Oak being preferred, and for the felloes ash is reckoned best.

Each felloe has, at least, two spokes. Sometimes, in place of separate felloes, one piece of wood is bent, by means of steam, into a complete circle for the rim of the wheels. Wheels made in this way are preferable in appearance, but the difficulty of repairing them has prevented their being brought into general use. There are two

Wheels.

kinds of wheels, the conical wheel, and the cylindrical wheel; of the former, there are the single dished and the double dished, and of the latter there are the straight wheel and the cross dished wheel. These we shall describe: Let a line be supposed to be drawn from the centre of the nave, at the in-head, to the centre at the out-head, and let this line be called the axis of the wheel. A wheel is single dished, when the spokes, being all one length, and diverging outwards from the carriage, form, with the axis of the wheel, acute angles towards the out-head. A wheel is double dished when each spoke alternately forms, with the axis of the wheel, a more acute angle towards the out-head than the others; all of them, however, at the circumference, terminating in one plane at right angles to the axis. The straight wheel is so called when the spokes stand perpendicularly to the axis in the same plane. The cross dished wheel derives its name from each two alternate spokes, forming, with the axis, an isosceles triangle, the spokes being alternately joined nearer to the out-head and in-head of the nave, but all of them terminating at the circumference in one plane, intersecting the axis between the roots of the spokes. For the properties of the different kinds here described, see Wheel.

IV. *Smith Work.*

Smith work.

There is great variety of smith work necessary in making a carriage, and as much dependence is put upon the iron work: it must be not only of the very best quality, but worked in the best possible manner; upon these accounts, ordinary bred smiths are not, without a good deal of practice, fit to be employed by coach-makers, except in the coarser parts. In order to obtain as much perfection as possible in the execution of this branch of the work, it is subdivided into particular departments: some workmen being constantly employed in making springs, others at the axle trees, others at the steps, some at the iron work upon the wheels, some at the different plates and stays for new carriages, and others at repairs upon old work of all kinds. The springs ought to be of steel, of the best quality, well worked and properly tempered, which is the chief art of the spring-maker. In spring-making there is a considerable nicety required in proportioning the thickness and lengths of the different plates, giving them an equal temper and proper set, in order to produce a regularly increasing resistance to any weight that may be put upon them. It is by these means that a carriage can be made equally easy to be rode in with one person only as with four or six. The axletrees ought to be built of different bars of iron, laid along side of one another, and well welded together; for this purpose the tire which comes off old wheels is preferred, and the thinner it is worn down so much the better, as a greater number of plies are necessary, thus receiving a better mixture of metal, and, of course, greater uniformity and average strength. The finishing of the axletrees ought to be done with the greatest possible accuracy, as much of the ease of draught depends upon that circumstance, and as the greatest part of the noise made by carriages, when in motion, proceeds from the axletrees and boxes not having been properly fitted to one another. A considerable degree of correctness is necessary in making the footsteps, the opposite legs requiring to be of exactly equal lengths, the joints solid and smooth that they may fold with ease, and at the same time not be liable to fail soon or get loose. The variety of iron plates and fastenings requisite for a carriage is so great, that it would exceed our bounds to describe them all;

we shall, therefore, merely mention, that almost every piece of wood in the *carriage* is supported by, or strengthened with iron, attached to the wood work by bolts or rivets passing through both.

A considerable degree of art and practice is required in putting the tire or iron hoop round the rim of the wheels; the holes for the nails to fasten it to the felloes are first made, the bar of iron is then turned round and formed into a circle of the required diameter, and the two ends welded together; it is then heated all round red hot, and the wheel being laid with its face (that is, the out-head of the nave undermost) upon a flat piece of stone-work or metal plate, the iron hoops, from the great expansion occasioned by its heat, goes easily upon the wheel; the iron is then immediately cooled, and, by contracting, binds all the wood work together; the nails are then put through the tire into the felloes, and the wheel, being cleaned off, is finished. Formerly the iron was, very generally, put round the wood-work of the wheel in separate pieces, having nothing to fasten it to the felloes except the nails, but this practice has almost gone into disuse.

The iron work for carriages, which open at the top, requires to be made with more than ordinary nicety. It is sometimes done, along with the other iron work, under the coach-maker himself; but it is more generally procured, along with a vast variety of small hard ware articles, such as locks, hinges, nails, &c. from makers at Birmingham, who do nothing else.

V. *Painting.*

Painting.

The first process of painting the body of a carriage, is to lay it all over with any common colour, in which a considerable proportion of japan and a little spirit of turpentine are mixed. Of this colour the body ought to get three or four coats, always increasing the quantity of turpentine, and diminishing the Japan: this is called priming for the grounding. After this, two or three coats of filling up, or grounding, composed of powder ochre, japan, and a considerable proportion of turpentine, must be laid on, betwixt the two first coats of which, if there are any holes above the heads of nails, or other small indentations in the pannels, they ought to be filled up with white-lead, ground in turpentine, and mixed up with japanners gold size. When all this is quite dry and hard, the painter, having flattened a piece of pumice-stone on one side, applies it with water to the pannels, and by constantly and regularly rubbing them all over, produces a smooth even surface. After this the body is laid over with a colour, preparatory to that with which it is to be finished. If the colour is ultimately to be light, the preparatory colour must be light also, and the reverse if the colour is to be dark. In this part of the operation, which is called priming for the body-colour, two or three coats will be necessary. When all these previous coats are quite dry, the body-colour is laid over them: and it depends upon the particular colour and shade what number of coats will be necessary. One coat must succeed another, until the colour is quite solid, that is, until there is no cloud or inequality of shade perceptible in any part of the whole. After this, the best copal varnish ought to be made use of; and a body cannot be well varnished without six coats, and seven if the pannels are to be polished. Betwixt each coat of paint, the pannels ought to be smoothed with sand-paper; and after every coat of varnish, they ought to be well rubbed down with pumice-stone, reduced to a very fine powder, put upon a piece of woollen cloth, made up into a roll as hard as possible, and moistened with water, care being taken to smooth the pannels in this way as much as possible, without rubbing through the varnish. The body-colour sometimes requires to be laid with varnish alone, and sometimes it is necessary to mix a little of the colour with the two or three first coats of varnish. To produce a better black, the upper quarters, roof, and back of the body, are done with japan in place of varnish, immediately after the colour; and to render it capable of being polished, one or two coats of varnish are put above the japan. When armorial bearings or letters are to be painted upon the pannels, the proper time is betwixt the first and second, or sometimes betwixt the second and third coat of varnish, after which such a number of coats ought to follow as will render the whole pannels smooth over the arms, crests, or letters.

Pannels ought not to be polished sooner than a month after the last coat of varnish is given them; and if the carriage is used during that time, or even for a longer period, before polishing, so much the better, the varnish by exposure to the atmosphere acquiring a harder consistency, and consequently becoming more susceptible of a fine polish. The first operation in polishing is to rub down the pannels as before described, with very fine pulverized pumice stone and water, thereafter with purified rotten-stone, and afterwards by constant rubbing with the palm of the hand, using a small portion of dry rotten-stone to remove the gummyness off the skin. When by these means the pannels are brought to a good polish, a little flour and sweet-oil rubbed over, gives a smoothness to the whole, and finishes the work.

As herald painting depends entirely upon the justness of the eye, the neatness of hand, and the taste of the painter, we shall not presume to offer any general rule for the execution of the work; neither can we give such a description of its progress, as will enable our readers to make any estimate of the difficulties to be overcome in this department. We shall only observe, that long practice, great taste, and persevering attention, are required to attain to eminence.

In painting *carriages*, there is nothing particularly worthy of remark. The painter's chief care is to remove all grease or oil from every part before he begins to paint, and as the work goes on, to smooth every coat with sand-paper before laying the next. In ornamenting the bars and wheels, every thing depends upon the steadiness of the hand in drawing the lines clean and well defined. The *carriage*, after being painted, ought to get two or three coats of varnish, to give it a lustre corresponding to that of the body.

VI. *Trimming.*

Trimmin

The trimmer's business is to cut the lining, give directions for sewing it, to arrange the lace properly upon the different parts, and, after being sewed, to stuff quilt and to fasten it into the body. This requires a considerable dexterity and neatness of hand. Much of the comfort of a carriage depends upon its being well lined and stuffed; and as every part of it is immediately under the eye of the people within, if any thing is left undone, or any error committed, it cannot escape notice, nor fail to give a bad impression of the whole machine. The trimmer has also to cover and finish the glass frames, blinds, shutters, budgets, footsteps, trunks, imperials, and to do every thing belonging to the inside (and outside leather work) of the bodies of either close or open carriages, &c. The lining of carriages is generally made of woollen cloth, sometimes of Morocco leather, and sometimes partly of both, trimmed with lace manufactured for the express purpose, made a fancy pattern, or with family arms, or crests, as may be wished. There are also interlinings, made generally of cotton cloth, used for the purpose of preserving the principal lining.

VII. *Harness Making.*

Harness-making.

There is no difficulty in harness making, that cannot be easily overcome by attention and perseverance. One man in this line cuts out all the leather for the different articles required, and makes up the work, that is to say, tacks a sufficient number of plies together in a temporary way for the purpose desired. They are then delivered to the workmen to be sewed, an operation in which, by practice, some attain to great perfection, using merely the common awl. The workman makes his own thread, from yarn waxed with wrought rosin, putting at each end a bristle, for the more speedy entering the holes made by the awl. In sewing the fine parts of the work, such as the bridle, pads, &c. an instrument is used called a pricker, which is similar to a number of points of large needles fixed in a handle in a straight line at certain equal distances, with this instrument, the workman marks his seam, by pressing it down where the sewing is to be, and following with his awl every mark made by the sharp points, is enabled to make his stitches with the regularity of work done by machinery. The winkers of the bridle is made of double leather, having betwixt the plies thin plates of iron, to keep them in their proper shape. The pads are made in a similar manner; but the iron plates are considerably thicker and stronger, to preserve the bent form, which is necessary for the horse's back, and also to afford a steady fastening to the bearing hook and turrets, through which the reins run. In the under sides of these pads are placed cushions, similar to the pannels of riding saddles, to protect the horse's back. In dressing leather for harness making, the curriers are careful to adapt the different hides to the uses for which they are naturally best fitted; some for harness, which ought to be the strongest and thickest; some for strapping, which does not require so much strength, and others for reins, which ought always to be of the best and firmest quality, dressed down to a proper thickness, and perfectly well pressed.

VIII. *Saddle Making.*

Saddle-making.

The saddle tree is got from a professed saddle tree maker. It ought to be made of well-seasoned beech, strengthened with canvass glued all over it, and with thin iron plates. The seat part of the saddle is generally covered with hog skin dressed for the purpose, formed to the curve of the saddle, by being drawn, when wet, as tightly over the saddle tree as possible, and allowed to dry in that position. It is supported by girth web, or strapping, drawn very tightly over, and nailed to the saddle tree transversely; the straps for the girths are attached to the web, and the whole is then covered with serge, and stuffed with fine wool. The skirts are made of crop, being a kind of bend leather first dressed smooth, and afterwards stamped in a press. These are sewed to the seat part, and the whole is then stretched over the tree, and nailed down. The sides of the pannels that go next the saddle are made of tanned sheep skin, the under sides of serge. The two are joined together by an edging or facing of hog skin about one and a half inches broad, and then stuffed with wool, and quilted. When finished, they are fastened into the saddle with small tacks.

IX. *Collar Making.*

Collar-making

The ring, or front part of the collar, is made of strong grained leather, the back part of black sheep skin. These two are sewed together by one seam. The ring is then stuffed as hard as possible with straw endwise; after this the back part is also stuffed with straw, and faced or lined with baked hair, to present a more elastic and smooth surface to the horse's neck. The collar is then sewed together at the upper end, and, upon the junction of the ring, a small leather top is put. The flaps, or side pieces, after being stitched all round the outer edge, and joined together at both ends, are drawn on, until their inner edges lie in the groove made by the ring and back part of the collar, and are, together with a small cap to cover the joining of the back part, sewed to the collar all round. The cap serves partly as an ornament, and partly to prevent the rain running down the horse's neck at the sides of the collar.

* * *

Principal improvements.

We have now to draw the attention of our readers to some of the principal improvements made upon carriages, from the period at which they came into general use. There are two things which would naturally suggest themselves to the mind as fit objects of improvement in carriages—the comfort of the people who ride in them, and the facility of their draught; accordingly almost all the alterations attempted have been made with a view to the one or the other. We are led, in the *first* place, to notice the introduction of springs and braces, as perhaps the greatest improvement of any, their adoption having the double effect of rendering a carriage more easy to ride in, and more easily drawn. It is mentioned in the Memoirs of the French Academy, that the idea of applying springs to carriages was suggested by M. Thomas in 1703, and that he actually gave a drawing of a carriage constructed upon that principle. It appears, however, from the same work, that he considered it an improvement rather of a theoretical nature, than one capable of being reduced to practice. The result, however, has proved the contrary; and whether M. Thomas is really entitled to the invention or not, we consider it as the greatest improvement that has ever been made in the construction of carriages.

The next improvement we shall mention is the present method of constructing carriages to open at the top, giving at once all the advantages of a close and open carriage. Although it is not long since this improvement was introduced, yet it has so gradually come to its present state of perfection, that we are at a loss to say when the first carriage of the kind was constructed which could be said completely to answer the intended purpose. The old-fashioned long perch carriages having been found to occupy a large space in turning, the crane neck was introduced for the purpose of remedying this inconveniency. The crane neck, however, soon gave way to the short perch, which is found equally to answer the purpose of turning in a short space, although it requires the body to be hung higher. The axletrees, known by the name of Colling's patent, ought not to be overlooked as a material improvement: they undoubtedly facilitate the draught, and save great trouble in oiling; they are ingenious in their construction, and afford considerable security.

The carriages, without perches and without braces, which have been introduced of late, may be considered worthy of notice as a variety; but we confess ourselves partial to the former construction, both perches and braces having, in our opinion, considerable advantages.

Many other improvements in axletrees have been attempted, and some with tolerable success; and to insure the safety of carriages, there have been brought forward many inventions worthy of being tried, and we have no doubt that some of them may turn out beneficial.

One of the latest improvements is that of making *carriages* totally of iron, which, among other advantages, possesses that of having more strength than those of the ordinary construction of the same weight. The first of this kind was applied to a heavy stage coach, licensed to carry sixteen passengers, besides baggage, and has hitherto required no repair, although the coach has already run upwards of 90,000 miles with the same velocity as the mail coach. Metal wheels have also been introduced, and axles of a new construction; and, upon the whole, the carriage forms such a contrast to any other we have seen, that we have been induced to give a Plate and description of it.

Plate CXCVIII. Fig. 1.

Fig. 1. Plate CXCVIII. shews the body of a chariot hung upon a patent iron *carriage*, iron wheels, axletrees, and boxes: the latter, by a simple contrivance, is close at the out-head, by which means the oil cannot escape, and the fastening of the wheel being at the in-head, as will be explained afterwards, gives great security, and prevents the possibility of the wheel being taken off by any other carriage running against it.

Fig. 2.

Fig. 2. shews the arm of an axletree turned perfectly true, with two collars in the solid, as seen at G and H. The part from G to B is made cylindrical. At K is a screw nail, the purpose of which will be explained in Fig. 6.

Fig. 3.

Fig. 3. is the longitudinal section of a metal nave, which also forms the bush, for the better fitting of which to the axletree it is bored out of the solid, and made quite air tight upon the pin; and for retaining the oil it is left close at the out-head D.

Fig. 4.

Fig. 4. represents a collet made of metal, turned perfectly true, the least diameter of which is made the same with that part of the axletree M, Fig. 2, and its greatest diameter the same with that of the solid collar G, Fig. 2. This collet is made with a joint at S, and opens at P. Two grooves are represented at *q q*, *q q*, which are seen also at the same letters in Fig. 5, as also the dovetail *r* in both Figures.

Fig. 5.

Fig. 5, is an edge view of the collet, Fig. 4.

Fig. 6.

Fig. 6, is a longitudinal section of an axletree arm, nave or bush, and fastening. AB, the arm of the axletree, bored up the centre from B to E. CCD, the nave, which answers also for the bush. PS the collet (see Figs. 4 and 5) put into its place. *q q*, two steel pins passing through the inhead of the bush, and filling up the grooves in the collet. *w w*, a caped hoop, sufficiently broad to cover the ends of said pins, and made fast to the bush by the screws *w*, *w*. This hoop, when so fastened to the bush, prevents the possibility of the pins *q*, *q* from getting out of their places. *u u*, a leather washer, interposed betwixt the inhead of the bush and the larger solid collar of the axletree, to prevent the escape of oil at the inhead. K, a screw, the head of which is seen at the same letter, Fig. 2. This screw being undone, and oil poured into the hole, it flows down the bore in the centre of the axletree arm, and fills the space B, left by the arm being about one inch shorter than the bore of the bush, and the screw being afterwards replaced keeps all tight. In putting on the wheel, a little oil ought to be put into the space betwixt the collet PS and the larger collar. The collet PS being moveable round the axletree arm, and being made fast to the bush by means of the two pins *q*, *q*, revolves along with the bush, and acting against the solid collar G of the arm, keeps the wheel fast to the axletree, until by removing the caped hoop *ww*, and driving out the pins *q*, *q*, the collet becomes disengaged from the bush. The dovetail seen upon the collet at *r*, Fig. 9, has a corresponding groove cut in the bush to receive it, in consequence of which the wheel must of necessity be put on, so that the collet and pins fit exactly. These wheels very rarely require to be taken of, and they will run a thousand miles without requiring fresh oiling.

Plate CXCVIII. Fig. 6.

The spokes of the wheel, made of malleable iron, are screwed into the bush or nave at CC, Fig. 6, all round. The felloes, composed merely of two bars of iron, bent into a circle the edgeway, are put on, the one on the front, the other on the back of the spokes, which have shoulders on both sides to support the felloes, and all three are attached together by rivets through them. The space betwixt the two iron rings forming the felloes, should be filled up with light wood, and the tire then put on, and fastened to the felloes by bolts and glands clasping both felloes.

Plate CXCIX. Fig. 1.

Fig. 1. Plate CXCIX. shews a bird's eye view of the main *carriage* composed of four separate bars of iron, of the curves represented and connected together, by means of the hoops marked A, and reaching from the spring bar H H before, to the axletree bed I I behind. These two bars are, in this sketch, supposed to be of wood, although by making the hind axletree, and the transome plate before, of such shape and strength as requisite, these bars of wood become unnecessary also. There is neither footboard nor budget shewn in this draught, in order that the construction may be the better understood; and as these carriages can be furnished with either, or both, in any of the modes in common use, any description of the particular manner of attaching them is unnecessary. The two centre iron bars, composing the perch, are attached to the fore and hind bars, at B, B, B, B, by means of strong screw bolts in the solid. The nuts are seen at *b*, *b*, *b*, *b*. The two outside iron bars of the perch, are connected with the fore and hind bars, by means of three bolts at each of their ends C, C, C, C, which bolts also fix on the springs to the *carriage*.

The holes marked in the iron bars at D, D, D, D, are for fixing the spring stays by means of bolts.

F F, G G, is the wheel upon which the under *carriage* turns, and is fixed to the transome bar, in the usual way, by bolts, the nuts of which are seen at *d*, *d*. A stay, reaching from A 1 to A 2, makes steady the back part of the wheel; the ends of this stay forming the glands for the two hoops, and the middle being fastened to the wheel by the bolts *b*, *b*. The stays F G, F G, are fastened by bolts to the wheel at their ends, and to the transome bar in the centre with the bolts *e*, *e*.

At E is seen the nut of the perch bolt, which is screwed above the transome bar.

The gland of the hoop A 3 is formed into shackles for receiving the bottom braces for the body. The hoops *u*, *u*, *u*, *u*, *u*, are for making the hind axletree fast to its bed, by which means there is no necessity for having a hole in the axletree.

Fig. 2.

Fig. 2. is a bird's eye view of the under *carriage*. AB the locking wheel and transome plate; D C, D C, the fitchell stays; D D the sockets through which the splintree bar passes; H the front socket, and G the hind socket for the pole; E the upper end of the perch bolt. Neither the axletree, splintree, or splintree bar stays, are represented, to prevent confusion.

Fig. 3.

Fig. 3. is a side view of the fore or under *carriage*; AB the locking wheel; DCC the fitchell stays, made fast to the axletree at C in the same manner with gig stay fastenings; DAB, stays upon which the wheel rests, and which are made fast to the wheel and to the fitchell stays at B, and being also bolted to the fitchell stays betwixt

Coach-making, Coal.

A and D, act as a string to a bow, preserving the fitchell stays DCC in their curve against the pressure of the carriage; H, the fore, and G the hind socket for the pole; K, the splintree bar and roller bolt; E, the top of the perch bolt. The splintree stays are left out here for the same reason as before.

Plate CXCIX. Fig. 4.

Fig. 4. is a representation of the front of the fore or under *carriage*: MM the axletree; AB the locking wheel and transome plate; KL, the splintree bar; DC, DC the fitchell stays; MN, MN, the splintree stays; AM, B M two strong stays which connect the locking wheel and axletree at the shoulders; H the fore, and G the hind socket for the pole; EF the perch bolt.

In Figures 2, 3, and 4, the several letters apply to the corresponding parts.

We have been thus particular in our description of these improvements, from the originality and simplicity of the principles upon which they are constructed, and from the ingenuity of their execution. To have supposed it possible to have made a *carriage* without a mortice or tenon, or wooden joint of any kind, would, only a short time ago, have been considered as absurd, but in the preceding construction this has been completely accomplished; and we cannot help thinking, that this of itself must be of great importance to all carriages, but more particularly to those for public use, where durability is the principal requisite. But this improvement appears equally applicable to carriages generally, as from the nature of the material made use of, it is not additional strength alone that is procured, but variety of shape, elegance, and lightness; for we are assured that these carriages are at an average one seventh lighter than those built on the ordinary construction.[*] (v)

COAL is an inflammable substance, of a very black colour, somewhat shining, opaque, soft, dry, and light in comparison with any of the strata in which it is found. It occurs in beds varying in thickness from an inch to many fathoms.

It is used for fuel, and is found widely scattered over the globe. The most valuable and extensive beds of coal which have been found and wrought, are in Great Britain.

This mineral is never found in the primitive nor transition rocks, but in a third class of rocks very regularly stratified, the most common of which are, 1st, sandstone, 2d, slate clay; 3d, indurated or fire clay; 4th, argillaceous iron stone; 5th, limestone; and 6th, greenstone. Of the two first there are very many varieties, both in respect of colour and hardness. In the coal, and in all its accompanying strata, distinct organic remains are found belonging to the animal and vegetable kingdom: the greenstone, however, is an exception, as it is questioned whether any organic remains have ever been found in that rock. In the sand stones, the forms of large trees, and jointed reeds, (arundo,) are found abundant, but impressions of shells are very rare. In the slate clay, the forms of large trees are seldom seen, but innumerable impressions of leaves, ferns, and moss plants, (cryptogamia,) are found in the area of a few feet; and it is remarkable that where the forms of shell fish are found in this kind of strata, they are never of the same substance as the matrix, but are always of argillaceous iron stone embedded in the slate clay. In the fire clay, a branched tree of singular appearance is most frequently found. The iron stone abounds with forms and impressions of plants, but more frequently with the forms of shell fish of the class

Coal.

Mytelus. The upper part of the coals have frequently the distinct impressions of large trees, and the lime stone is in many instances a congeries of marine animals. In the sand stone, where forms of trees are found, the bark or exterior part is of coal only, which is very thin, of a bright shining black colour, and cubical.

From the very regular stratification of this field of the mineral kingdom, the vast beds of inflammable matter it contains, the great abundance of organic remains found in it, and as none of the primitive or secondary rocks are connected with the strata, it has therefore very properly been denominated by the celebrated and great mineralogist Werner, *the independent coal formation.*

Coals, with their various accompanying and parallel strata, are found lying in every inclination to the horizon. Some of them are vertical, others nearly horizontal, but never absolutely so to any considerable extent. The most common dip or declination is from 1 in 5, to 1 in 20. A bed of coal, as to its form or shape, considered in the abstract, is generally somewhat semicircular or semi-elliptical; and is the segment of a flat bason. There are some instances where the bason shape is complete, the slips and dislocations of the strata which occur, derange the general form; still, however, each segment evidently partakes of the bason form. In some few instances the form is quite the reverse, as if the coal bed was formed by being revolved round a cone. The vertical coals do not partake of this bason shape, which might be easily inferred from their peculiar situation.

We are inclined to conclude from practical observation, that the forms of coal fields depend upon the shape of the primitive or secondary rocks, upon which they certainly rest. Coals, we believe, and as far as our investigation goes, are never found in veins in the mountain rocks, similar to those in which metals occur.

The *coal formation* is found chiefly in the northern hemisphere, and abounds in the countries lying nearly in the same latitudes with Great Britain. Coal is found in Siberia, Canada, Newfoundland, and Cape Breton; also in France, Germany, and Sweden. It is likewise said to be found in the northern parts of China. In the southern hemisphere, it is stated to be very abundant in New Holland, but we have no distinct accounts of coal in the continent of Africa.

As to the surface of the ground under which coal is found, it is much doubted if any peculiar character exists, (as has been advanced by some mineralogists) in Great Britain. It is found under every variety of surface, excepting the wild and rocky mountains. It is, however, to be remarked, that a great part of the valuable and extensive coal field of South Wales, is found in a mountain district, and the strata of the coal field form these mountains even to their summits, which are elevated not only very much above the level of the sea, but also above the adjoining country. These hills are smooth and covered with verdure, and present no rocky cliffs on account of their comparatively soft strata. Hence the existence of coal in any district of country, not mountainous, cannot be deduced from the appearance of the surface, but rather from the relative situation of the particular district with respect to the rocks of the primitive or secondary class.

Of coals there are various species, viz.

Cubical coal.

1. *Cubical Coal*.—Is black shining, compact, and moderately hard; when wrought, it turns out in quadrangular masses, and when broken small, the fragments are

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[*] We are happy to have it in our power to lay before our readers an account of the great improvements which have been recently made upon carriages, by H. R. Brown, Esq. Edinburgh. The uncommon elegance of the carriages which he has constructed, and the great ingenuity which is displayed in the formation of his patent axletree and wheels, will do more to recommend them to notice, than any praise of ours; and we have no doubt but that the inventor and patentee will be rewarded by the patronage of the public. Ed.

cubical. The lamellated structure, or what is termed the reed of the coal, is always parallel to the bed or strata upon which it rests, as is the general case of all coals, with a very few exceptions. Of this coal there are two kinds, the caking coal, and the open burning coal. The caking coal of the best kinds, however small when kindled, undergoes a semi-fusion, and unites into a solid mass. The open burning coal, burns more rapidly than the former, with much flame and heat; the caking coal is very abundant in England, the other is abundant both in England and Scotland. The cubical coals which unite when set on fire, are known by the name of caking or smithy coals; the open burning coals by the name of rough coal, cherry coal, and clod coal.

The Whitehaven caking coals, in the west of England, according to Kirwan, contain

Carbon,	56.8
Asphalt and Maltha, the former predominating,	43
	99.8

Specific gravity 1.250.

Slate coal.

2. *Slate Coal*—Is black, compact, and much harder than the first species; dull in the colour; in working turns out in large quadrangular masses, which can with ease be split into very thin pieces, similar to slates, hence the name. This coal is open burning, and produces much flame and smoke; it contains a greater proportion of white ashes than the cubical coals. Some of the inferior kinds of this coal burn with difficulty, and produce a great quantity of white ashes. This coal is commonly known by the name of splint coal, and, according to Kirwan, contains

Carbon	47.6
Maltha	31.6
Ashes	20.8
	100.0

Specific gravity 1.426.

Glance coal.

3. *Glance Coal*—Is black, with bright metallic lustre, and brittle; it has the external characters of the preceding species of coals, but the chemical properties of charcoal, hence termed by some mineralogists *native mineral carbon*. It burns with considerable heat, with a blue lambent flame, produces no smoke, and leaves a small proportion of ashes; it appears to have a portion of sulphur in direct combination, so that in burning it gives out a most suffocating effluvia, it produces no soot, but on the contrary whitens the places where the fumes are condensed. This kind of coal abounds in Ireland, and is known by the name of Kilkenny coal; it is the blind coal of Scotland, and the malting, or stone coal of Wales. This coal approximates to the graphite or plumbago species, and in some instances passes into it. From the trial of several specimens, it contains of carbon from 72.05 to 90.00. Specific gravity, 1.526.

Cannel coal.

4. *Cannel Coal*—Is black, with little lustre; in working turns out four-sided columnar, breaks with a conchoidal fracture, in any direction, like pitch, ignites very easily, and burns with a very bright flame like a candle, from which it derives its name. It is found very abundant in the coal field at Wigan, in Lancashire, where there is an entire stratum of it about four feet thick, without a mixture of any other coal. It produces very little dust in working, and does not soil the fingers as the other coals do; varieties of this coal are found in Scotland, forming frequently part of the thickness of the common coals. What is termed pitch coal by some mineralogists, is only a variety of this species. The cannel coal, when first kindled, decrepitates very much, throws the burning splinters to a distance, and is on this account dangerous; it is said that this fault is corrected by immersing the coals for some time in water, previous to their being used for fuel. In Scotland this coal is termed parrot coal, or bottle coal.

It contains, according to Kirwan,

Carbon	75.
Maltha	21.7
Ashes	3.12
	99.82

Specific gravity 1.232.

Sulphureous coal.

5. *Sulphureous Coal*, is of a dull black colour, mixed with a great proportion of pyrites. Though pyrites is found in distinct pieces in coal, this occurrence does not constitute it a sulphureous coal, because the pyrites can easily be picked out; but sulphureous coal, properly so called, has the pyrites so interwoven with its texture in small veins, or so intimately combined with the principles of the coal, that the sulphureous parts cannot be separated. It is very unsafe to work such coals, because if any quantity of the small coals produced in working is left below ground, a decomposition ensues, heat is generated, and the mine is set on fire, of which there have been many instances. When laid in heaps above ground the same result ensues, hence it is very unsafe to be put on board a vessel for a voyage of any considerable length.

This coal is very heavy, and yields a large proportion of ashes.

Culm coal.

6. *Culm Coal*, is of a dull black colour, small and dusty, by some mineralogists it is reckoned a distinct kind of coal, at least such is said to be the case in Sweden. What is termed culm in Great Britain, is the refuse or small dusty coal produced in working the common coals; it contains much earthy matter, will not kindle in an ordinary fire place, but produces a considerable heat and flame in a furnace, where a strong current of air is introduced; it also produces a very great proportion of ashes. In England it is exempted from the high duty imposed on the other coals.

Bovey coal.

7. *Bovey coal*, or bituminous wood, is found in alluvial land, though some mineralogists affirm that it is found in the rock stratification. It is composed of trees, reeds, and rushes embedded in the alluvial earth, the form of the trees, the ligneous and fibrous texture, being, in most cases, distinct; their texture is impregnated with petroleum, and combinations of the sulphuric acid. When first dug up, the fibres are flexile; in burning, it produces little heat, and a very unpleasant smell, and is only used where other kind of fuel is scarce and in high price. In England it is found in greatest abundance at Bovey near Exeter, from which it derives its name; it also abounds in many parts of the continent, particularly in Germany.

Two hundred grains of Bovey coal, according to Hatchett, yielded,

Water turbid and mixed with bitumen	60 grains.
Thick brown oily bitumen	21
Charcoal	90
Hydrogen gas, carbonated hydrogen, and carbonic acid	29
	200

According to Professor Jameson there are five subspecies of this inflammable matter, classed under the name of *Brown coal*.

The foregoing are the principal kinds of coal known in commerce, and used for economical purposes. In each kind various shades of difference exist, both with respect to texture and quality.

With regard to the economical uses of the coals be-

Economical uses of coal.

fore mentioned, we shall state them briefly: The cubical and slate coals are chiefly used as fuel in private houses, and in all manufactories where a strong heat is required; the caking coals are most suitable for smith's fires; when any of these coals are made into coaks, they produce an intense heat in the blast furnace for the making of iron, being used with success in place of charcoal; the slate coals of the best kinds suit this purpose excellently, as from their strong texture they bear a heavy load of iron stone, and a strong blast.

The coals of South Wales employed in the making of iron, contain less volatile matter than either the English or Scotch coals; so that in producing a ton of pig iron, only about half the quantity of coals is requisite, as a given quantity contains a great proportion of carbon. That able and practical chemist, Lord Dundonald, whose genius merited a high reward, invented a process by which the volatile parts of the coal were condensed, producing volatile alkali, oil, and tar; the coals thus distilled were converted into excellent coak, and applied for the purpose of making iron; this beneficial plan has only been adopted in a few instances, particularly at Coalbrookdale in England, and at Muirkirk in Scotland.

For the production of intense heat and flame in a furnace, the slate coals are most suitable, as, by keeping open, they admit a constant supply of air, which preserves a vehement combustion; on this account they are in great request by the Scotch and Irish distillers.

Glance coal is used in Ireland as common fuel, and sells at a high price. It is much used for drying grain and malt; to these it imparts a fair colour; it is for this latter purpose that the Welsh and Scotch coals, of this kind, are chiefly used. It is also used for the burning of lime, for which it is very suitable.

Cannel coal is chiefly used for common fuel: that which is found in Lancashire admits of being turned on the lath, and is made into a variety of utensils and ornaments, being susceptible of a very high polish, nearly equal to that of jet; and of the various coals it is said to be the most suitable for producing the coal gas used for lighting upl arge manufactories.

Sulphureous coal is but very little used, being so dangerous to work; it is only suitable for the burning of lime, the making of salt, or for producing sulphate of iron.

Culm is used for burning of lime, making of salt, and for steam engines; it sells at a very low price. There is but a small consumpt for this coal in comparison of what is produced annually in the mines.

Bovey coal is only used as common fuel by the poorer classes of the community, where better fuel cannot be had.

Origin of coal.

With respect to the origin of coal, naturalists have in general concluded that it is from the vegetable kingdom, particularly from the result yielded by distillation, which is as follows:—

Watery phlegm,
Volatile oil,
Volatile alkali,
Thick oil,

which last, on being rectified, produces a transparent thin oil; but it is remarkable that this oil, by exposure to the air, becomes black like animal oils.

Various theories have been brought forward regarding the formation of coal, and in these much learning and ingenuity have been displayed. From the incontestible and evident traces of vegetables found so very abundantly in the strata of the coal fields, together with the above analysis of coal, and the strong light and heat evolved in burning, we are inclined to concur in idea with those who conceive it to be of vegetable origin. All the patient investigation of mankind regarding this point of natural history, will never produce an absolute and satisfactory conclusion on the subject, there being such insurmountable difficulties, particularly when we consider that many of the vegetable remains found in the coal strata of Great Britain, belong to classes of plants which are now found only to exist in the equatorial regions; a fact which favours a theory brought forward by some naturalists, viz. that at the great and universal deluge, the poles of the earth were changed considerably from their position. The formation of our globe, together with the causes which produced the various convulsions and dislocations which have so evidently taken place in the mineral kingdom, must ever remain veiled in a dark impenetrable cloud. We must, however, conclude, that this vast magazine of fuel is most evidently placed by an all-wise Being in the bowels of the earth, in such positions and situations, as are most apt and convenient for the use of man, and where his industry and ingenuity may be exercised.

Coal being an article so indispensibly requisite for mankind in civilized society, it is of great importance to learn every particular regarding its natural history, so that its existence may be traced, by a distinct analogy, in countries widely separated. And when coals are found, it is also very important that the most approved practical and œconomical plans may be applied for working them to the best advantage. The mode of searching and boring for coal; the detail of the most approved plans now used for working the mines; descriptions of the dislocations and obstructions which most frequently occur in coal fields; together with the general economy connected with the working of coal mines, will be given under the article MINE. (R. B.)

COLLIERY, a place where coals are wrought. See MINE.

COALBROOKDALE. See SHROPSHIRE.

COAT-OF-ARMS. See ARMS and HERALDRY.

COBOEA, a genus of plants of the class Pentandria, and order Monogynia. See BOTANY, p. 171.

COBALT. See CHEMISTRY *Index*, and ORYCTOGNOSY.

COBBE. See DARFUR.

COBITES. See ICHTHYOLOGY.

COBLENTZ, the *Confluentia* of the ancients, is a town of France, in the department of the Rhine and Moselle, situated at the confluence of these two rivers, from which circumstance its name is derived. Coblentz forms a perfect triangle, one side of which extends along the Moselle, and the other along the Rhine. The streets are in general very regular, and are well paved and lighted, and the houses, which are chiefly of three stories, are built of stone. The long street of Rheinthor, which traverses the whole town, is reckoned the finest, though it is not uniformly straight.

There are two collegiate churches at Coblentz, viz. the churches of St Castor and St Florin; three parish churches, viz. that of the Court, that of Notre Dame, and that of St Castor; besides the church of St John, which formerly belonged to the Jesuits, and four convents of monks. The collegiate church of St Castor is very old, and the place on which it stands was once an island in the Rhine. The large and solid dome is supported by columns of the Corinthian order, which are admired for their lightness. In the choir, which is very beautiful, are four paintings by J. Zick, representing the history of St Goar and St Castor. Above the choir, and near the principal altar, which is ornamented with a cross of gilt copper, from seven to eight feet high, are the tombs of several archbishops.

The church of St Florin is next in point of antiquity to that of St Castor. The choir is adorned with fourteen paintings, by J. Zick, representing the passion of our Saviour.

The parish church of Notre Dame is large and well lighted. It is distinguished by its spires, which are very lofty, and of uncommon architecture. On the southern side of one of these is a dial, which, along with the hour of the day, shews the phases of the moon. This church has several beautiful altars of marble, but is too narrow in proportion to its length.

The convent of the Dominicans, situated on the Moselle, and built in the 15th century, is the only one worthy of notice. The church is fine, and its principal altar magnificent. It is built wholly of stone, and is adorned with several very fine sculptures.

The gymnasium or college, is a very fine building, situated in the middle of the town. By the large square which is before it, by its two entrances, and by its proximity to the church of St John, which it touches, it adds greatly to the beauty of the street called *Firmung-strasse*.

The bridge over the Moselle, built of stone, was erected in the 14th century. It is 528 feet long, and has 14 arches sufficiently high to permit small vessels to pass below them, without lowering their masts. The bridge of boats, or the flying bridge, by which passengers cross the Rhine to Thal-Ehrenbreitsten three times every hour, is a very interesting object.

The palace of the electors of Treves was formerly situated on the opposite side of the Rhine, at the foot of the rock on which the ruins of the castle of Ehrenbreitsten once stood; but from the danger and inconveniences of this situation, a new palace was built about 25 years ago, on the left bank of the Rhine, a little to the south of the town. It fronts to the west, and has two fine circular wings. The central building is three stories high, and has a fine projecting entrance, consisting of eight columns of the Doric order, supporting a balcony, and capable of receiving carriages in the time of rain. The back front, towards the Rhine, is ornamented with six columns, which support a bas relief of beautiful workmanship. The whole building is surrounded with an avenue, planted with fine trees. This magnificent palace, however, is now in ruins, and is used as barracks.

At a short distance to the south west of the town is the Chartreuse, which is situated on the top of several mountains, which rise insensibly one upon another. The mountain upon which it is built, consists of clay, which is used for pottery ware, and from the top is to be seen one of the most beautiful and extensive prospects. This monastery is now in ruins, and is inhabited only by an innkeeper.

The other objects of curiosity at Coblentz, are the fort of Marceau, on the road to Andernach, the tombs of General Marceau, and General Hoche. There is also another monument erected to General Hoche, not far from Weissenthierne, opposite to Neuwied. The *Dikasteriul-Bau*, and the theatre are also fine buildings.

On the opposite side of the Rhine stands the Fauxbourg, called Thal, and the celebrated fortress of Ehrenbreitsten (*Heribertii Saxum.*) This fortress, which is now in ruins, is situated on the summit of a stupendous rock, which rises 800 feet above the bed of the river. Before the demolition of this fortress, it was considered impregnable, when defended by a competent garrison. It was ascended by three difficult and winding paths, one of which is now broken;—it communicated with Coblentz by tunnels cut through the solid rock, and it was supplied with water from a well 286 feet deep. The view from the top of the rock is considered as the finest on the banks of the Rhine.

Coblentz is surrounded with mountains covered with vineyards, and a great deal of wood grows in the arrondissement. It carries on a small commerce in the productions of the country, and the only manufacture is one of Japanned tinned goods. Population 10,000. E. Long. 7° 4′, N. Lat. 50° 24′. See *Coblentz ein hist. topograph.* Versuch *von Lessoux*, *Coblentz*, 1803. (*π*)

COBOURG, *Melocabus*, or *Coburgum*, a town of Germany, in the kingdom of Saxony, situated upon the river Jesd, in a valley between two mountains. The town and the suburbs are surrounded with a wall. There are here four churches, and likewise a college, founded in 1597 by John Casimir duke of Saxony, and endowed by him with many valuable privileges. In the church of St Maurice is the tomb of the Duke John Frederick. The other objects deserving of notice is the collection of prints belonging to the prince, the cabinet of natural history and medals, the ducal garden, the arsenal, and the new promenade. The inhabitants work a great deal in petrified wood, which is found in large quantities in the surrounding country. E. Long. 10° 58′ 0″, N. Lat. 50° 15′ 18″. (*w*)

COCCINELLA. See ENTOMOLOGY.

COCCOCYPSILUM, a genus of plants of the class Tetrandria, and order Monogynia. See BOTANY, p. 121.

COCCOLOBA, a genus of plants of the class Octandria, and order Trigynia. See BOTANY, p. 205.

COCCUS. See ENTOMOLOGY.

COCHIN, COCHIM, or COCCI, a seaport town of Hindostan, on the coast of Malabar. It received its name from the small river Cocci, which formerly discharged itself there into the sea. In the year 1341, when the sea threw up the island of *Vaypi* or *Baypin*, which is about 13 miles long and 1 broad, on the north side of Cochin, the torrents from the Gauts broke through the banks of the river, swept away the village, and formed a huge river, a lake, and a harbour of such capacity, that large vessels can anchor in safety on the north side of Cochin when the river throws itself into the sea. The enormous hills of sand which the sea throws up in June and July, are washed away by the river in August and September, and, at these seasons, the struggle between the torrents and the ocean often alters greatly the appearance of the coast. The inhabitants of the island of Vaypi begin their æra at the period of its origin.

The city of Cochin was built by the Portuguese in the 10th century, after the arrival of Vasco de Gama at Calicut. It is nearly of a semicircular form, and is about a mile and a half in circuit. Six large bastions and a cavalier defend it on the landside, and an irregular work on its eastern side; while a strong wall, terminating towards the east in a ravelin before the cavalier, and having loop holes for the admission of small arms, protect it on the water side. In 1778, the governor, Adrian Moses, repaired the fortifications of the citadel, and supplied it with new ditches, bridges, batteries, and bastions. A wet ditch encircles the works, and before it is a covered way and a glacis. There is also a ravelin between the bastion Gelderland, and the beach.

Cochin is intersected with beautiful streets, which, though wide and cleanly kept, are not adorned by many handsome houses. The principal public buildings are the government house and the church. The government house, the residence of the governor, is a spacious and airy mansion fronting a large plain. The mainguard stands opposite to it, and on the left side are the barracks for the governor's body guards. The church is a large and oblong building. The fine cathedral, which was built by the Portuguese, was employed by the Dutch as a store-house, in which they kept the sugar from Batavia, the cinnamon from Ceylon, together with the nutmegs, cloves, iron, copper, cordage, rice, pepper, and various other articles of merchandise, which they sold to the native princes. There is also here a city hotel, annually farmed out by the goverment, where strangers are provided with lodgings. Cochin has three gates, one to the north, leading to the river, called the Water Gate, another to the east called the New Gate, and another to the west called the Bay Gate.

Although Cochin is not fortified according to the rules of art, it could only be taken by a regular siege. Approaches could only be made from the south, where there is a dry and level plain; for to the east, as far as the rivers, there are several morasses, which would greatly impede an attack from that quarter. The security of the city would be much increased by destroying the woods, which lie about a mile and a half south east from the town, and also those which cover the southern part of the island of Vaypi. The enemy would thus be deprived of the materials for constructing their batteries, and for filling up the morasses and ditches in their way. Cochin was taken by the English in 1795. E. Long. 75° 16′ 15″, and N. Lat. 9° 56′ 30″. For further information on this subject, see Baldæus's *Description of the Coasts of Malabar and Coromandel,* p. 111—136, Amsterdam, 1672. Valentin's *Beschryving van't Nederlandsck Comptoir op de Kust van Malabar.* Amst. 1726. Hamilton's *New Account of the East Indies,* from 1668 to 1672, vol. i. and ii. p. 321. and London, 1739. Bartolomeo's *Voyage to the East Indies.* p. 126, 130, &c. Stavorinus' *Voyages to the East Indies,* vol. iii. p. 228. *Annales des Voyages* par M. Malte Brun. vol. vi. p. 216. (*x*)

Situation. COCHINCHINA, a kingdom in Asia, extends from about the 10th to the 20th degree of North Latitude, and is bounded by the kingdom of Tonkin, or Tung-quin on the north; by the gulf of Tung-quin, and the Chinese sea, on the east; by the Indian ocean on the south; and by a ridge of high mountains, which separate it from Cambodia, on the west. It stretches along the side of the Chinese sea from 600 to 700 miles, its breadth bearing no proportion to its length; for, in general, its breadth, from east to west, does not exceed a degree, and in many places is not above 20 miles. The whole country is intersected by rivers which descend from the mountains, and which, though not large, are very favourable to inland navigation. The climate is healthy, similar in temperature to Tung-quin, but milder by its vicinity to the ocean.

Productions. The face of the country exhibits but few marks of tillage, nevertheless it is not unfruitful. In the rainy season, which lasts during the months of September, October, and November, the low lands are subject to inundations from the mountains, which continue for three or four days at a time. These, like the overflowings of the Nile, contribute very much to the fertility of the country. Of rice, they have generally two plentiful crops every year, one in April and the other in October; that grain requiring no other manure than the mud deposited by the torrents which issue from the mountains. Oranges, bananas, figs, pine-apples, greavas, pomegranates, and other fruits of inferior quality, are produced in great abundance in all parts of the country. Indeed all the fruits of India, and many of those of China, are to be found here in the greatest perfection. They have also good yams, and plenty of a sweet kind of potatoes. Sugar canes and tobacco are cultivated in large plantations. The juice of the former, after undergoing a partial refinement, is exported to China in cakes; but the latter is consumed in the country, for persons of every age and rank indulge in the habit of smoking.

The timber of this country is the finest in the world, and it may be said to afford the same supply to China that Norway does to Britain. Their oak, pines, and teak, are admirably adapted for ship-building; and their mountains also abound with a species of wood, which, from possessing the power of preservation under earth and water, is called by the natives *the incorruptible tree.* Their forests also produce a variety of scented woods, as the rose-wood, eagle wood, and sandal wood, all of which fetch very high prices in the China market. Their cinnamon, though of a coarse grain, and strong pungent flavour, is preferred by the Chinese to that of Ceylon. On the mountains of the Kemois there grows a tree, the wood of which is most fragrant, and is supposed to be the same with *lignum aloes.* Being accounted the most valuable wood in the country, it sells from 5 to 16 ducats per pound, and the profits belong to the king. But in China and Japan it fetches not less than 200 ducats per pound, and is formed into beds for the emperor and nobility. It is also used in the funeral piles of those Indians, who still continue to burn their dead. Some gold and silver mines, as well as some species of diamonds, have been found in this country, but the latter are not deemed so valuable as pearl. On coral and amber they set a high value.

Domestic animals and food. Of domestic animals, they have almost every species except sheep. The country abounds with small horned cattle, short-legged hogs, kids, ducks, and fowls. Their cattle being of a small breed, do not supply them with much milk; but they seem to have no great desire for that article, for they do not give it even to their children, whose food consists chiefly of rice, sugar-cane, and water melons. Like the Chinese, they feed on dogs, and frogs are also a very common article of food. To the inhabitants of the coast, who form the greater part of the population, the sea is a never-failing source of sustenance; and the great extent of sea coast enables them to avail themselves of the inexhaustible stores which that element supplies. For catching the fish they employ a net, and sometimes wicker baskets; and vast quantities of flying fish are taken by sinking deep earthen jars with narrow necks, baited with pork, or the offals of fish. The great body of the people, like the Chinese, have but two meals in the day, one about nine in the morning, the other about sunset; and in the dry season these are usually eaten before the doors of their cottages, on mats spread in the open air. They do not cultivate the grape, but drink a liquor brewed from rice.

Wild animals. The wild animals are such as are common to India, viz. the boar, tyger, rhinoceros, elephant, buffalo, with abundance of deer. In the forests of this and the neighbouring countries, the elephants are said to be of a larger size than in any other part of the world; and the hunting of the elephant, the tyger, and the buffalo, is an amusement with which the sovereigns entertain foreign ambassadors. On these occasions they celebrate the *royal feast of elephants,* which has probably given rise to the report that the Cochinchinese feed on the flesh of those animals.

Sea-slug.

Curious nests.

The numerous little islands, which lie along the coast of this country, afford an article of luxury in very great demand in China, called the *Trepan* or *Bichos da mer*, which is a species of sea slug. Vast quantities of this little animal are also collected on the northern coast of New Holland, and carried to the Chinese market. Captain Flinders, who was sent out on a voyage of discovery to that coast, learned that not less than sixty vessels made an annual voyage regularly for the sole purpose of collecting these marine productions, during the preceding twenty years. After being detached from the rocks, they are opened, washed in fresh water, and boiled, then dried in the smoke of green wood, in nearly the same manner as our red herrings are prepared. In the same islands, running parallel with the coasts of Cochinchina, and known in the charts by the name of the *Paracels*, another valuable article of export is found, namely, those celebrated nests made by a small bird about the size of our swallow, and cemented with a kind of gum, the different layers of which may be separated in the same manner as the coats of an onion. When this gum has been dissolved in warm water, it is used for seasoning fish, and dishes of various kinds; to sauces it also communicates an exquisite taste, and hence it becomes a valuable article in the Chinese market. These islands also abound with turtles, of so delicate a flavour, that, in order to obtain them, the inhabitants of this and the neighbouring countries fight desperate battles.

Origin.

Until a few centuries after the Christian æra, Cochinchina formed a part of the Chinese empire; and the general features of the natives, particularly in the northern provinces, their customs, their written language, their religious opinions and ceremonies, still indicate their Chinese origin. They also, in many respects, resemble the Tung-quinese, with whom they have a common origin, and from whom they differ very little in their mode of life. Although it is the tendency of all revolutions to change the character and manners of a people, and although that observation in many respects holds true, with regard to the difference betwixt the present, and the former manners and customs of the Cochinchinese, yet, in their diet and superstitions, their marriages and funeral ceremonies, their games, music, and entertainments, and in the greater part of their ordinary life, they exactly resemble the people from whom they have been separated. Instead, therefore, of entering into a minute description of these, we shall refer the reader to the article China, and confine our observations to those manners and customs, which may be termed peculiar to this country.

Appearance of the natives.

The general appearance of the Cochinchinese is by no means engaging to the eye of a stranger. The women have no pretensions to beauty; but, unlike the morose and secluded Chinese, they do what they can to compensate for the want of personal charms by a lively and cheerful temper. Both sexes have coarse features, and dark complexions; and their universal custom of chewing areca, or betel, by reddening the lips and blackening the teeth, gives them a disgusting appearance. They are, however, represented as gentle, hospitable, enterprising, and industrious. Few crimes are to be found among them: robbery and murder are unknown. A stranger is every where received with the most eager curiosity, but at the same time with the greatest benevolence and hospitality.

Dress.

The dress of this people has undergone a considerable change from that of the Chinese. Indeed the dress of the men differs very little from that of the women, being chiefly confined to a jacket and a pair of trowsers; and both sexes go bare-legged, and generally bare-footed; but the women in the higher ranks wear a kind of sandals or loose slippers. Their long black hair, like that of the Malays, is usually twisted into a knot, and fixed on the crown of the head. This is the ancient mode in which the Chinese wore their hair, until the Tartars, on the conquest of the country, compelled them to the ignominy of shaving the whole head, except a little lock of hair behind. Short hair is therefore now accounted a mark of vulgarity, and even of degeneracy.—A loose cotton frock, of a brown or blue colour, reaching down to the middle of the thigh, and a pair of wide black nankeen trowsers, compose the usual clothing of the women. When they wish to appear better dressed, they put on three or four frocks at once, of different colours and lengths, the shortest being uppermost. Some wear handkerchiefs tied round the head, in the shape of a turban; others have hats, or caps, of various materials, for protecting their faces against the rays of the sun; and for the same purpose they use umbrellas made of China-paper, or of the leaves of palms, and sometimes fans made of feathers. Their children, till the age of eight or nine years, have no clothing, and yet appear uncommonly stout and healthy.

Customs and manners.

The following account of a public dinner given to the officers of British ships, and other gentlemen who composed an embassy to this country, may serve to illustrate the manners of the inhabitants. "As none of the houses in the town were large enough for the accommodation of so numerous a party, the Governor issued his directions for building a spacious shed, which, by the help of the ever-ready and useful bamboo, was finished in the course of a few hours: the roof and the sides were covered with thick close mats. Within this shed was placed a row of little tables, with forms on each side, to which might sit down conveniently from twenty to twenty-four persons. In China it is the custom to cover these little square tables so completely with dishes, or rather bowels, that no part of their surfaces shall be seen; but the Cochinchinese seem to have improved upon the liberality of their highly polished neighbours, by not merely covering the table, but by piling the bowls in rows upon each other three or four in depth. Of table linen, knives, forks, bottles, and glasses they make no use; but before each person is laid a spoon of potters ware, and a pair of porcupine quills or small sticks of bamboo, of rose or sandal wood, sometimes tipped with silver or *tootanague*, of the same kind in every respect as those used by the Chinese, and known to the English under the name of *chop-sticks*. The contents of the bowls are preparations of beef, pork, fowls, and fish, cut into small pieces, mixed with vegetables, and dressed in soups and gravies, variously seasoned, and composed of various materials. We had nothing roasted, nor prepared in the dry way. Neither wine nor spirits, nor fermented liquors of any kind, nor even water, were served round during the time of eating; but when dinner was over, Chinese *seau-choo* was handed about in little porcelain cups." Barrow's *Voyage to Cochinchina*, p. 287.

Degradation of the female character.

In this, as in all other countries where civilization has made but little progress, the females are doomed to the most laborious occupations. They may be seen standing from morning to night, in the midst of pools of water, up to the knees, occupied in transplanting rice. They undertake the labours of tillage, and the various employments of agriculture; while those who live in the seaports, besides the management of their domestic concerns, undertake the superintendance of the various branches of commerce. They even assist in constructing and repairing the cottages; they conduct the manufactures; they ply the boats in the rivers, and in the harbours; they carry the articles of produce to market; they weave the cotton into cloth, dye it, and make it into dresses for themselves and their families. But nothing can be a stronger proof of the degradation of the female character, and the unceasing labour to which they are doomed, than the proverbial expression in the country, "that a woman has nine lives, and bears a great deal of killing." The younger part of the males are compelled to enrol themselves in the army; and the rest are employed in fishing, in felling timber, in building and repairing ships and boats, and in preparing articles of export for the China market; but leaving always a considerable portion of time for some favourite amusement.

Amusements.

An idea of the nature of their amusements will be best formed from the account which Mr Barrow gives of an entertainment prepared by the inhabitants, on the fourth of June, in honour of the birth-day of the king of Great Britain. "We were conducted from the place of landing, to a temporary building, on a larger scale than that which we had hitherto occasionally occupied. The two pitches of its roof were supported by a row of bamboo poles, which running down the middle, divided the building into two parts. The sides of the roof were covered with thick double mats, and lined within with coarse Manchester cottons of various patterns."—"In the farther division of the building, a party of comedians was engaged in the midst of an historical drama, when we entered; but on our being seated, they broke off, and coming forward, made before us their obeisance of nine genuflexions and prostrations; after which they returned to their labours, keeping up an incessant noise and bustle during the day. The horrible crash of the gongs, kettle-drums, rattles, trumpets, and squalling flutes, were so stunning and oppressive, that nothing but the novelty of the scene could possibly have detained us for a moment. Their airs, rude and unpolished as they were, appeared to be regular compositions, and were sung in exactly measured time. One in particular attracted our attention, whose slow melancholy movement breathed that kind of plaintive softness so peculiar to the native airs of the Scotch, to which, indeed, it bore a very close resemblance. The voices of the women were shrill and warbling, but some of their cadences were not without melody. The instruments at each pause, gave a few short flourishes, till gradually overpowered by the swelling and deafening gong. By different gestures of the head, body, and arms, the dancers assumed a variety of figures; and all their motions were exactly adapted to the measure of the music."—"The Cochinchinese are very fond of theatrical amusements; the actors are busily engaged in their performances the whole day, proceeding apparently with as much ardour when there are few, or even no spectators present, as when there were many. Being hired for the day, a crowded or a thin audience makes but little difference to the performers; all their concern being the receipt of their pay on the finishing of their labour."—"Leaving the comedians in the midst of their labours, we walked across the village green, which was also the market-place, where we were highly entertained with a variety of sports and gambols. The fourth of June was for once a day of general festivity, in this part of Cochinchina. In one place we observed about a dozen of young fellows, playing at foot ball, with a bladder; in another, they were displaying their agility, by leaping over an horizontal pole; here a noisy groupe were amusing themselves in fighting cocks; there boys, in imitation of their elders, were training quails, and other small birds, and even grasshoppers, to tear one another in pieces; and in every corner gamesters were playing cards, or throwing dice. But that which most attracted our attention, was a party of young men keeping up a shuttle-cock in the air, by striking it with the soles of their feet. Nothing, indeed, could exceed the activity and energy of the men of Cochinchina. Active as they were in the use of their feet, their manual dexterity was not less remarkable. Jugglers, and conjurors, and posture-makers, were exercising their respective arts for the amusement of the crowd, and for their own advantage; and we found to our cost, that those who did not openly practise juggling as a profession, were equally expert in the art of picking pockets." P. 295, &c.

Arts and manufactures.

Their arts and manufactures are, as may be supposed, in their infancy, and do not appear to be in a state of progressive improvement. There is in this, and in all Oriental governments, a radical defect, which must ever operate against all national improvements; and that is, the want of a permanent security to property. In a country where the hand of arbitrary power can, at any time, dispossess a man of his property, what encouragement can he have to build an elegant house, to improve the cultivation of his land, to aim at perfection in any art, or, in short, to extend his ingenuity or industry, much beyond a supply of the mere necessaries of life. Their best houses are constructed of wood or bricks, which have been dried in the sun, are limited to one story, are thatched, and require constant attention to prevent them from mouldering into dust. On the low grounds, and in the neighbourhood of rivers, the houses are usually raised upon four posts of wood, or pillars of stone, to protect the inhabitants from vermin, and from inundations. Their city walls are but ill calculated for duration. The mass of loose earth heaped in the middle, has a constant tendency to push out the bricks or stones with which it is cased, so that the whole soon crumbles into a heap of ruins, and is buried under a rapid and vigorous vegetation. The houses in Turon, one of the sea-port towns, were, in general, clean and comfortable, and sufficiently compact to protect the inhabitants from the heat of the sun at one season, and the heavy rains at the other. Their household furniture is scanty, and rude in its construction. An earthen stove, an iron pot to boil their rice, which forms their chief article of food, a pan to fry their vegetables in oil, and a few porcelain cups and bowls, compose their domestic utensils. The floors of their houses are, indeed, covered with matting, ingeniously woven in different colours; but the art of making mats is so common among all the nations of the East, that the most beautiful are scarcely admired. Their vessels of cast iron are well executed, and equal in quality to those of the Chinese, but their earthen ware is far inferior. They work in metals with tolerable neatness; and as they are an acute and ingenious people, they might, under proper encouragement, make a rapid progress in the arts and manufactures.

Naval architecture.

The art in which they excel most, at present, is naval architecture, for which the size and quality of their timber is admirably fitted. Their row-gallies, built for pleasure, are very fine vessels; from 50 to 80 feet in length; and are sometimes composed of only five single planks, which extend from one extremity of the vessel to the other; the edges being morticed, kept tight by wooden pins, and bound firm by twisted fibres of bamboo, without ribs, or any kind of timbers. The company always sit in the forepart of the boat, and the servants and baggage occupy the stern; but as it would be deemed a breach of good manners in the rowers to turn their backs on the passengers, they stand with their faces towards the bow of the boat, and push the oars from them, instead of pulling towards them. Their foreign traders are built on the same plan as the Chinese junks, and are capable of carrying a great burden, but with more safety than speed. These vessels are divided into distinct compartments, by planks two inches thick, well caulked, and completely water tight; so that one ship may accommodate several merchants. A ship thus secured with cross bulk heads, may strike on a rock without sustaining any serious injury; and if a leak spring in one direction of the hold, it is not attended with any damage to the articles which fill the other.

Religion. The religion of the Cochinchinese, like that of almost all the Oriental nations, is a modification of the widely extended doctrine of *Buddha*, but apparently more simple, and less disguised with mysteries than that religion as practised in China. Their temples are, in general, very humble buildings, without the heavy curved roofs, or towering pagodas of the Chinese; but in many parts of the country there are monasteries amply endowed, of which the buildings are extensive, and enclosed with walls. These religious houses are supported by yearly contributions, levied by government, which, in the country, consist of the produce of the soil in kind; and, in the towns, of money, metals, clothing, and similar articles. From a pious sentiment of gratitude, they offer to the image of the protecting deity the firstlings of their flocks, and the first fruits of the earth; but, like other idolatrous nations, the Cochinchinese are extremely superstitious. When an infant dies, the parent endeavours to appease the offended deity by offerings of rice, oil, tea, money, or whatever he supposes may be acceptable. And, from the same principle of superstitious fear, large wooden stakes, or pillars, are erected in various parts of the country, for the purpose of marking the spot, where some public or private calamity may have happened, as the loss of a battle, the murder of an individual, or other calamity, and as a propitiation to the evil spirit, by whose influence it is supposed to have been produced.

Morals. The moral system of this country, as in China, is founded upon the precepts of Confucius; here, however, very little regard is paid to the external forms of morality. In that respect they are completely the reverse of their northern neighbours. Far from affecting the gravity and moroseness of the Chinese, they are gay and talkative, open and familiar; and the women are as gay and unreserved as the men. We have already remarked, that the female character is held in a state of complete degradation. The women are, indeed, considered as beings of an inferior nature to the men, by whom they are regarded as formed only to minister either to their wealth or their pleasure. Hence the morals of the females, married and unmarried, are extremely licentious; neither the husband, nor the father, having any scruples in abandoning the wife, or the daughter, to her gallant. In the married state, polygamy is not only tolerated, but unlimited by any law or rule; and here, as in China, the wife of the first marriage claims precedence, and takes the lead in all domestic concerns. The terms, on which the parties are united, are not more easy than those by which they are separated. The breaking of one of their copper coins, or a pair of chop-sticks, between husband and wife, before proper witnesses, is considered as the dissolution of their former compact, and the act of separation. These observations are not confined to the morals of the lower orders of the people: they apply not less forcibly to the first ranks in society, and to the officers of government; at least such is the general character of those resident in Turon and its environs, though the manners of a nation are not always to be estimated by what is found to prevail in the neighbourhood of a sea-port. It does not, however, appear that they have adopted from the Chinese, and other eastern nations, the inhuman practice of infanticide.

Language. The Cochinchinese have accurately preserved the written characters of the Chinese language, but the language which they speak is considerably different from theirs. But this is not surprising when we consider the various dialects which prevail in provinces of the same kingdom, and that the inhabitants of the northern and southern provinces of China are unintelligible to each other. People, however, who visit Cochinchina, find far less difficulty in making themselves intelligible than in China. While the morose and unbending Chinese will not condescend to employ the pencil to delineate objects, nor explain their meaning by signs or gestures, the accommodating Cochinchinese are ready to adopt any plan for the purpose of facilitating their intercourse with strangers.

History. Cochinchina was originally subject to the Chinese government; but having engaged in rebellion with the kingdom of Tung-quin, it became exposed to different usurpers, and both states were compelled to return to their former dependance about the 50th year of the Christian æra. The imperial authority, after its re-establishment, subsisted in Cochinchina till the year 263, when a powerful native, named Kulien, undertook to deliver his country from a foreign yoke. The descendants of that successful usurper enjoyed the throne of Cochinchina till 653; but with regard to the succeeding kings, the Chinese history is very defective.

In 1280, the king of Cochinchina, having heard of the revolution which had made the Mogul Tartars masters of all China, sent to the new emperor deputies loaded with presents, in order to pay him homage. The deputies were honourably received; but the Emperor, not content with tribute, carried his pretensions farther, and attempted to seize the government of the country. This occasioned another war with the Chinese, in which the kings of Cochinchina maintained their independence by paying the usual tribute to the emperor.

The Mogul Tartars having been expelled from China, the new emperor, upon his accession to the throne, sent a friendly deputation to the king of Cochinchina, and the latter sent his tribute to the new monarch. In 1373 the king of Cochinchina carried fire and sword into Tung-quin; and a long and bloody war betwixt these two monarchs ensued, which was not terminated till the year 1471, when, after a desperate battle, the king of Tung-quin became absolute master of Cochinchina. It, however, again recovered its independence, and continued afterwards to be governed by its own kings. Excepting one attempt made by the Tung-quinese to subjugate this country in 1671, in which they were unsuccessful, they have remained peaceably within their own boundaries, while Cochinchina has subdued the mountaineers, and even the kings of Tsiampa, and Camboya, whom she has compelled to pay tribute. From that period, till the year 1774, little or nothing is known of the history of that country; but, from the information of a Monsieur Barissy, a French officer who commanded a frigate in the service of his Cochinchinese majesty, Mr Barrow has been enabled to lay before the public a very curious and interesting sketch of its recent revolutions, and its present political state, of which the following is an abstract.

In the year 1774 an insurrection commenced, headed by three brothers, Yin-yac a merchant, Long-niang a general officer, and the third a priest, whose name is unknown, by which Caung-shung was deprived of the throne of Cochinchina, and he, and as many of his family as fell into the hands of the rebel party, were put to death. The kingdom was then divided among the three, and Long-niang soon made war on the king of Tung-quin, a vassal of China, and obliged him to flee to Pekin for the purpose of demanding assistance. Kien-long, the emperor, ordered his *invincible* army, under the Viceroy of Canton, to march and reinstate the king of Tung-quin; but the politic Long-niang, (who had assumed the title of Quang-tung,) laid waste the country, and soon obliged them to retreat from want of provisions, the army of his opponent having lost, by famine and the sword, nearly 50,000 men. The Viceroy Foo-chang-tong was obliged to negotiate, but his antagonist refused to yield the title to the kingdom of Tung-quin. Foo-chang-tong, more fitted for the cabinet than the field, resolved to employ finesse, and he represented to the emperor that his invincible army had performed most wonderful feats, but that the supposed usurper was much beloved by the Tung-quinese, and had a fair title to the abdicated throne; and that it would be politic to invite him to the court of Pekin, to perform the accustomed ceremonies and duties of vassalage. Instead of making his personal appearance, however, the wary Long-niang imposed upon the court of Pekin one of his generals, as his representative. The mock king was favourably received, and sent back: but Long-niang, puzzled by this unexpected issue, rewarded the faithful service of his representative by putting him and the whole of his suite to death, in order to prevent a discovery of the deception.

At the time of the insurrection, a French missionary, named Adran, resided at the court of Cochinchina, as tutor to the son of the king, and from the general wreck and slaughter he rescued the queen, and the prince, with the princess, and their infant son. Their first concealment was in a wood, under the branches of a *royal* banyan tree; and after the ardour of search had subsided, the fugitives proceeded to Sai-gong, where the prince was crowned as king, under the name of Caung-shung. A large army, however, sent by Yin-yac the *merchant king*, compelled the royal family again to flee, and they embarked on the river of Sai-gong, and landed in a small uninhabited island in the gulf of Siam. There the king was joined by about 1200 of his adherents; but the usurper preparing an expedition against him, Caung-shung resolved to throw himself on the protection of the king of Siam. This monarch granted an asylum to the exiled prince; and, being at war with the Birmans, he accepted of his proffered assistance, which, by the aid of the European tactics taught to Caung-shung to Adran, was so effectual, that, in a short time, the Birmans were compelled to sue for peace. Jealousy of his talents, however, and suspicion of ambitious views, raised in Siam a party against poor Caung-shung; and he was obliged, at the head of his faithful followers in arms, to force his way out of the capital of Siam, to re-embark on some Siamese vessels and Malay proas seized in the harbour, and again to occupy his old island; which, with the guns taken from the vessels, he fortified in such a manner as to be equally secure against the king of Siam and his own rebellious subjects.

While these events were passing, Adran had visited the southern provinces of Cochinchina, and finding the sentiments of the people hostile to the usurper, he resolved to sail for France, and to apply to its court for effectual assistance in reinstating the king on his throne. He took with him from Pondicherry the son of Caung-shung, and arrived at Paris in 1787. His project was presented and adopted; and, in the course of a few months, a treaty was signed at Versailles between Louis XVI. and the ambassador of the king of Cochinchina, a full copy of which is given by Mr Barrow. In that treaty, it is stipulated among other things, that France shall immediately furnish to her ally a fleet of 20 ships of war, with five regiments of French, and two of colonial forces, to be under the absolute command of the king of Cochinchina; and shall also immediately advance one million of dollars, half in specie, and the other in arms and ammunition. In return, the king of Cochinchina ceded, in perpetuity to France, the bay and peninsula of Turon, with the adjacent islands; stipulated to furnish 14 ships of the line, with stores and tackling; to admit an establishment of officers of the marine in his dominions; and to allow the French consuls to build any number of vessels in his ports; and, for that purpose, to fell any quantity of timber in his forests. And in the event of the king of France being at war with any power in India, he is permitted to raise and discipline in the European manner 14,000 Cochinchinese soldiers; and the king is to provide 60,000 more, disciplined in the manner of their country.

It is unnecessary to point out the policy of the court of France in framing that treaty, which, happily for the interests of the British East India settlements, was frustrated, partly by the influence of the mistress of Conway, the governor of Pondicherry, but principally by the event of the French revolution. Adran, created bishop by the court of France, and appointed plenipotentiary, proceeded to Pondicherry, and although he was then crossed in his purposes by the intrigues of Madame de Vienne, as already mentioned, yet he did not desist from his grand design of reinstating Caung-shung on the throne. With the young prince he proceeded to the coast of Cochinchina, where he learned that the king, after a miserable subsistence of two years on the island, had been induced, by the circumstance of the two usurpers contending with each other, to land in his kingdom; that the people had risen in his support; and that the royal party had proceeded to Sai-gong, the works of which they had put into a good state of defence. There they were joined in 1790 by bishop Adran, and measures were taken during that year, for equipping an army and a fleet.

In 1791, the rebel Long-niang, alias Quang-tung, died, and Caung-shung immediately commenced his operations, by surprising, attacking, and destroying the fleet of Yin-yac, the *merchant king*; and in 1793, the southern part of the kingdom had submitted to the lawful sovereign. Yin-yac did not long survive the destruction of his fleet, for he died that same year. His son succeeded, and was dispossessed of his capital in 1796. Against the son of the other usurper, who kept possession of the kingdom of Tung-quin, this *Gustavus* of Cochinchina was preparing an armament in 1800. "Although no authentic accounts since that period have reached Britain, there is good reason to believe, that he has reconquered the whole of that country."

From what Caung-shung has atchieved, it must be acknowledged that he is a great and extraordinary man. By the aid of an education, which may be called European, he has risen superior to those around him; and his superiority does not consist merely in patience, in fortitude under suffering, or in the achievement of victory, but by civil regulations, and by the introduction of arts, he has done much to civilize his country: the industry, ingenuity, and energy of his people are excited, and probably they will soon be enabled to assume a more elevated rank among the nations of Asia. During the short intervals of peace which he has been permitted to enjoy, he has laboured, by the wisest institutions, to promote the peaceful as well as the warlike arts among his subjects. He has encouraged agriculture and manufactures of every denomination; he has established public schools in every part of his dominions; he has caused a regular survey to be made of the whole sea-coast, and buoys and land marks to be erected in the dangerous places; he has opened mines, and erected smelting furnaces. With a view to the military improvement of his country, he employed the faithful Adran to translate into the Chinese language, a system of European tactics for the regulation of his army; and applied himself to the erection of a marine with such indefatigable activity, that, in 1800, he had actually a fleet of no less than 1200 vessels, several of them of European construction, and the whole trained to manœuvre by signals, according to the most approved methods of modern times. He is very desirous to have the assistance of European officers, and men of science, in the different departments of his government; and has himself no mean knowledge of many of our useful arts. To shipbuilding in particular, he has applied himself with such persevering industry, that he is said to have purchased a Portuguese vessel, for the express purpose of taking it in pieces, plank by plank, with his own hands, fitting in a new piece of similar form and dimensions, till the whole had been completely renovated. While he pays a scrupulous regard to the maxims of Confucius, he openly declares his great veneration for the doctrines of Christianity, and tolerates it and all other religions.

The following is Mr Barrow's account of the daily life of this extraordinary personage, who in 1807 was in the 51st year of his age. "To enable him the better to attend to the concerns of his government, his mode of life is regulated by a fixed plan. At six in the morning he rises from his couch, and goes into the cold bath. At seven he has his levee of mandarins: all the letters are read which have been received in the course of the preceding day, of which his orders are minuted by the respective secretaries. He then proceeds to the naval arsenal, examines the works that have been performed in his absence, rows in his barge round the harbour, inspecting his ships of war. He pays particular attention to the ordnance department; and in the foundery, which is erected within the arsenal, cannon are cast of all dimensions. About twelve or one he takes his breakfast in the dock-yard, which consists of a little boiled rice and dried fish. At two he retires to his apartment and sleeps till five, when he again rises, gives audience to the naval and military officers, the heads of tribunals, or public departments, and approves, rejects, or amends whatever they may have to propose. These affairs of state generally employ his attention till midnight, after which he retires to his private apartments, to make such notes and memorandums as the occurrences of the day may have suggested. He then takes a light supper, passes an hour with his family, and between two and three in the morning retires to his bed; taking in this manner at two intervals, about six hours of rest in the four-and-twenty."

His forces, as stated by captain Barissy, were in the year 1800 as follows:

Army.		*Men.*
24 squadrons of buffalo cavalry		6,000
16 battalions of elephants (200 beasts)		8,000
30 battalions of artillery		15,000
		29,000
Brought forward		29,000
25 regiments of 1200, each trained in the European manner		80,000
Infantry with matchlocks, sabres, &c. trained in the ancient manner of the country		42 000
Guards regularly trained in European tactics		12,000
Land forces		113,000
Marine.		
Artificers in the naval arsenal	8000	
Sailors registered and borne on the ships in the harbour	8000	
Attached to the European built vessels	1200	
Attached to the junks	1600	
Attached to the 100 row galleys	8000	26,800
Total		139,800

Money.

The Japanese is the only current money in Cochinchina, and is paid and received by weight. The money of the country is of copper, as large as our common counters, of a round figure, and has a hole in the middle, by which it may be strung in the same manner as beads.

Commercia advantage

Cochinchina is extremely well situated for commerce. It lies in the direct line of our navigation to China, and in the immediate vicinity of the islands in the Indian Archipelago; and the commodious harbours formed on its coasts, particularly at Turon, afford a safe retreat for ships of any burden in the most tempestuous seasons. It furnishes many articles of great value in the Chinese market, and might open a ready market for many of our manufactures. Besides a variety of valuable scented woods, its forests contain an inexhaustible store of teak, and other timber for ship-building, of which our supply in other eastern countries is said to be both scanty and precarious; and its fertile vallies yield abundance of rice, sugar, pepper, silk, cotton, and other vegetable productions. Among the articles of luxury, which are at all times in demand by the Chinese, may be enumerated the areca nut, cardamoms, ginger, and other spices; the nests already described; the Bichos du Mar, or sea slugs, in commercial language called *trepan;* the fins of sharks; and many marine productions of a gelatinous quality, both animals and vegetables. A rich gold mine has, it is said, been opened near Hué, the northern capital, and gold dust has been brought at different periods from the mountains. Silver mines also have been discovered, and the silver is now brought to market in bars about five inches long, and in value about eleven Spanish dollars. These articles, so valuable in China, might be taken by us in exchange for our various manufactures in iron and steel; our woollens, cottons, and muslins; our naval stores; our opium, and other drugs; all of which have at various times been disposed of in Cochinchina at an advance of 30 per cent. and their value paid in ingots of silver. By a trade of that kind, were there a British factory established at Turon, as much specie might be saved to Great Britain, or to our settlements in India, as the value of the commodities might amount to in China; and if the Chinese government shall ever carry into effect a threatening which they have often held out, of excluding foreign traders altogether from their ports, our trade might still be carried on, and perhaps with greater advantage, by means of Chinese junks bringing cargoes of tea and silks and other articles to Cochinchina, and thus avoiding the exorbitant duties levied at Canton on foreign vessels. In this manner too, an advantageous trade might be opened up to the numerous islands which lie scattered in the Indian and Chinese seas, some of which have of late years been wrested from the hands of our enemies; and the Siamese and Cambodians, and other neighbouring nations on the continent, might be induced to bring the produce of their respective countries to Cochinchina, and barter it with us for such articles as they want. Mr Barrow is of opinion, from what he observed of the disposition of the people at Turon, that neither the king of Cochinchina, nor the natives, would be averse to an intimate connection with the British, provided suitable overtures were made to them in a direct manner by *the British government itself*, and not through any *commercial body*, to whom, like the Chinese, they pay no respect. And as their trade with China, which formerly employed upwards of two hundred of their largest vessels, has been wholly suspended since the rebellion in the country, he believes that it would not be difficult for Britain, the greatest maritime and commercial power in the world, by prudent management, to establish an intercourse so obviously beneficial to both countries. The thoughts which he suggests upon that subject deserve attention.

See Barrow's *Voyage to Cochinchina.* Grosier's *Description of China*, vol. i. p. 300. *Exposé Statistique du Tonkin de la Cochinchine du Camboge*, &c. tom. ii. p. 1. *Annales des Voyages*, par M. Malte Brun, tom. iii. (A. P.)

COCHINEAL, the name of a valuable scarlet dye obtained from an insect, the Coccus *Cacti* of naturalists, which is found on the *Cactus opuntia*, or prickly pear tree called *Nopal*, or *Nopallica*, by the Indians. As the natural history of the insect itself will be given under the article ENTOMOLOGY, and the method of using the dye which is obtained from it under the article DYEING, we shall confine ourselves at present to such economical details as do not belong to either of these articles.

The *Cactus opuntia*, or *Nopal*, on which the insects are reared, is generally planted by the Indians near their habitations, in an argillaceous earth mixed with gravel and stones. In holes about half a yard deep, and about two yards distant from each other, one or two leaves of the nopal are placed in a flat position, and then covered with earth. These leaves grow up into a single stem, which divides into branches that successively produce fresh leaves. The stem and the branches are full of knots, from which the leaves grow. The plant is usually about three yards in height. The decayed branches are carefully removed, and the plants are kept free of all kinds of weeds. A collection of these trees forms a *Nopalerie.* The female cochineal insects are placed, about the 15th of October, in a number of small nests among the leaves of the nopal, and they immediately wander over the plant in quest of the particular branches to which they attach themselves, and during the time of breeding they are preserved with the utmost care from violent winds, frosts, &c. and from the depredations of particular birds and worms. After attaining their full growth, they are put into earthen pots, and when they have been confined for some time, they are killed and put into bags.

The following curious details respecting cochineal are abridged from the writings of Humboldt, which contain not only the most recent, but the most correct account of this singular insect that has yet been published.

The rearing of the cochineal, (*Grana Nochiztli*,) is of great antiquity in New Spain; and it is probable that it goes beyond the incursions of the Toltec tribes. In the time of the dynasty of Aztec kings, the cochineal was more general than at present. There were nopaleries not only in Mixtecapan (la Misteca), and in the province of Huaxyacac (Oaxaca), but also in the intendancy of Puebla, in the environs of Cholula and Huejotzingo. The vexations to which the natives were exposed in the beginning of the conquest, and the low price at which the encomenderos forced the cultivators to sell the cochineal, occasioned this branch of Indian industry to be everywhere neglected, excepting in the intendancy of Oaxaca. It is scarcely 40 years since the peninsula of Yucatan still possessed considerable nopaleries. In a single night, all the nopals, on which the cochineal lives, were cut down. The Indians pretend that the government took this violent resolution to raise the value of a commodity, of which they wished to secure the exclusive property to the inhabitants of Misteca. On the other hand, the whites maintain that the natives, irritated and discontented with the price fixed by the merchants on the cochineal, came to a general understanding, to destroy at once, both the insect and the nopals.

The quantity of cochineal which the intendancy of Oaxaca furnishes to Europe, may be estimated in common years, including the three sorts, *grana*, *granilla*, and *polvos de grana*, at 4000 *zurrones*, or 32,000 *arrobas*, which, calculating the arroba at 75 double piastres, amounts to 2,400,000 piastres. The cochineal exported from Vera Cruz, was

In 1802.	Arrobas.	Value in Double Piastres.
Grana Fina, ...	43,277	3,303,470
Granilla, ...	2,355	50,472
Polvos de Grana, . .	1,322	14,615
Total, ...	46,954	3,368,557

In 1803.	Arrobas.	Value in Double Piastres.
Grana Fina, ...	27,251	2,191,399
Granilla, ...	1,573	40,226
Polvos de Grana, . . .	786	7,048
Total, ...	29,610	2,238,673

But since the produce of one harvest is often augmented by a portion of the produce of the preceding year, the progress of cultivation cannot be determined from the quantity exported. The nopaleries in general increase very slowly in Misteca. In the intendancy of Guadalaxara, scarcely 800 arrobas of cochineal are produced annually. Raynal estimates the whole exportation of New Spain at 4000 quintals, an estimate too low by one half. The East Indies have only begun to pour their cochineal into commerce; but the quantity is very inconsiderable. Captain Nelson carried off the insect from Rio Janeiro* in 1793, and nopaleries have been established in the environs of Calcutta, Chittagong, and Madras. Much difficulty was experienced in procuring the species of cactus proper for the nourishment of the insect. We do not know if this Brasilian cochineal transported to Asia, be the mealy species of Oaxaca, or if it be the cotton cochineal (*grana silvestre*).

Humboldt had occasion to observe the wild cochineal in the kingdom of New Granada, Quito, Peru, and in Mexico, though he was not fortunate enough to see the fine cochineal; but having consulted persons who had lived long in the mountains of Misteca, and having had at command extracts from several manuscript memoirs, drawn up by order of the Count de Tessa, during his stay at Mexico, by alcaides and ecclesiastics of the bishopric of Oaxaca, he obtained some useful information respecting an insect which has become of the very first importance to European manufactures.

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* This cochineal is the *Grana silvestre.* It was first cultivated at Rio Janeiro in 1770, by M. Henriquez de Payra, who has written a detached history of it, with many plates, the MS. of which is in the archives of the Academy of Lisbon.

The fine cochineal differs from the wild one, not only in size, but also in being mealy and covered with a white powder, while the wild one is enveloped in a thick cotton, which prevents its rings from being distinguished; but the metamorphoses of the two insects are the same. In those parts of South America where for ages the wild cochineal has been reared, it has never yet lost its down. It is true, that in the nopaleries established by M. Thiery at St Domingo, it was thought to be observed, that the insect under the care of man increased in size, and underwent a sensible change in the thickness of its cotton covering; but M. Latreille, who is inclined to look upon the wild cochineal as a different species from the fine one, believes that this diminution of down is merely apparent, and that it must be attributed to the thickness of the body of the insect. The rings on the back of the female being more dilated, the hairs covering this part must appear less close, and consequently clearer. Humboldt was informed by several persons who had long lived in the neighbourhood of Oaxaca, that sometimes among the small *coccus* recently brought into the world, individuals are observed covered with very long hair. But it must not be forgotten, that the fine cochineal, on leaving the body of the mother, is wrinkled in the back, and covered with twelve silks frequently very long, which disappear when it becomes adult. Those who have not attentively compared the offspring of the fine cochineal, with that of the wild cochineal, are naturally struck with the presence of these hairs. The fine cochineal appears powdery ten days after its birth, when it frees itself from its fringy dress of small silks, whereas the wild cochineal is more and more covered as it gets older, its down thickens, and the insect resembles a small white flake, at the period which precedes the conjunction of the two sexes.

It is sometimes observed in the nopaleries of Oaxaca, that the winged male of the fine cochineal couples with the female of the wild cochineal. This fact has been cited as an evident proof of the identity of the species; but we commonly see in Europe *coccinelles* couple together essentially different in their form, shape, and colour. When two species of insects are in the same vicinity, we ought not to be astonished at their coupling together.

M. Thiery thought himself warranted in maintaining, that the fine cochineal and the plant on which it feeds, are both found wild in Mexico, and that the insect and the nopal of the plantations of Oaxaca, have been insensibly modified in their form by means of long culture. This supposition, however, appears equally gratuitous with that which would pronounce grain, maize, and the banana, to be degenerated plants. The coccus cacti has an infinite number of enemies among the insects and birds. Wherever the cotton cochineal propagates of itself, it is not to be found in any abundance, from which we may easily conceive that the mealy cochineal must have been still more rare in its native country, because it is much more delicate, and not being covered with down, is more sensible to the cold and humidity of the air. In discussing the question, whether the fine cochineal would propagate without the care of man, the subdelegate of the province of Oaxaca, Ruiz de Montaya, (*Gazeta de Literatura de Mexico*, 1794, p. 228.) cites a very remarkable fact in his memoir, "that at seven leagues distance from the village of Nexapa, there is a place where, favoured by particular circumstances, the most beautiful *grana fina* is to be found, on very high and very prickly wild nopals, without any pains having ever been bestowed in cleaning the plants, or in renewing the offspring of the cochineal." Besides, we are not to be astonished, that even in a country where this animal is indigenous, it should seldom be found in a wild state, from the time that it began to be in request among the inhabitants, and to be reared in nopaleries. It is probable that the Toltecs, before undertaking so troublesome a species of cultivation, collected the fine cochineal on the nopals, which grew spontaneously on the sides of the mountains of Oaxaca. Gathering the females before laying, the species would soon be destroyed; and to obviate this progressive destruction, and prevent the mixture of the cotton and mealy cochineals on the same cactus, (the former depriving the latter of all nourishment,) nopaleries were established by the natives.

The plants on which the two species of cochineal are propagated, are essentially different; and this undoubted fact is one of those which indicate a primitive difference between the *grana fina*, and the *grana silvestre*. Is it probable if the mealy cochineal were merely a variety of the cotton cochineal, that it would perish on the same cactus which nourishes the latter, and which botanists designate by the names of *Cactus opuntia*, *Cactus tuna*, and *Cactus ficus indica*? M. Thiery asserts, that in the plain of Cul-de Sac in St Domingo, the cotton-cochineal does not live on the *Cactus tuna*, but on the *Cactus pereskia*, which he classes among the articulated Indian figs; and Humboldt believes that this naturalist has confounded a variety of opuntia, with the true pereskia, which is a tree with large and thick leaves, and on which he never yet found any cochineal. He considers it also as extremely doubtful, whether the plant called by Linnæus *Cactus coccinellifer*, cultivated in Europe, is the nopal on which the Indians of Oaxaca rear the mealy cochineal. M. Decandolle, (*Plantes grasses de M. M. Redouté et Decandolle*, livraison 24.) appears to be of Humboldt's opinion; for he cites the wild nopal of Thiery de Menouville, as synonymous with the cochineal Indian fig, which is entirely different from that of the plantations. Linnæus indeed gave the name of *Cactus coccinellifer* to the Indian fig, with which several botanical gardens of Europe had received the cotton cochineal, a species with a purple flower, (*Ficus Indica vermiculos proferens* of Plukenet,) which grows wild in Jamaica, the island of Cuba, and in almost all the Spanish continental colonies. Humboldt shewed this cactus to well-informed persons, who had carefully examined the nopaleries of Oaxaca, and they uniformly told him, that the nopal of the plantations is essentially different from it, and that the latter is never to be found in a wild state. The Abbé Clavigero, also, who lived five years in Misteca, expressly says, that the fruit of the nopal on which the fine cochineal is reared, is small, insipid, and white, while the fruit of the *Cactus coccinellifer* is red. Ulloa maintains that the true nopal is without prickles; but he appears to have confounded this plant with an Indian fig, which is found in the gardens (*conucos*) of the Indians of Mexico and Peru, and which the creoles, on account of its gigantic size, the excellence of its fruits, and the beauty of its articulations, which are of a bluish green, and destitute of prickles, designate by the name of *Tuna de Castilla.* This nopal, the most elegant of all the opuntia, is in fact fit for the nourishment of the mealy cochineal, especially after its birth; but it is seldom to be found in the nopaleries of Oaxaca.

In the intendancy of Oaxaca, the Indians do not all follow the same method in rearing the cochineal, which M. Thiery de Menouville saw practised in his rapid passage through San Juan del Re, San Antonio, and Quicatlan. The Indians of the district of Sola and Zimatlan establish their nopaleries on the slope of mountains, or in ravines, two or three leagues distant from their villages. They plant the nopals, after cutting and burning the trees which covered the ground. If they continue to clean the ground twice a year, the young plants are able to maintain the cochineal in the third year. For this purpose, the proprietor of a nopalery purchases, in the months of April or May, branches or joints of the *Tuna de Castilla*, laden with small cochineals, (*semilla*) recently hatched. These branches, destitute of roots, and separated from the trunks, preserve their juice for several months. They are sold for about three francs the hundred in the market of Oaxaca. The Indians preserve the semilla of the cochineal for twenty days in caverns, or in the interior of their huts, and after this period they expose the young coccus to the open air. The branches to which the insect is attached, are suspended under a shed covered with a straw roof. The growth of the cochineal is so rapid, that even in the months of August and September, we find mothers already big before the young are yet hatched. These mother cochineals are placed in nests, made of a species of tillandsia, called *paxtle*. They are carried in these nests two or three leagues from the village, and distributed in the nopaleries, where the young plants receive the semilla. The laying of the mother-cochineal lasts from thirteen to fifteen days. If the situation of the plantation is not very elevated, the first harvest may be expected in less than four months. It is observed, that in a climate more cold than temperate, the colour of the cochineal is equally beautiful, but that the harvest is much later. In the plain, the mother cochineals grow to a greater size, but they meet with more enemies in the innumerable quantity of insects, (*xicaritas, perritos, aradores, agujas, armadillos, culebritas,*) lizards, rats, and birds, by which they are devoured. Much care is necessary in cleaning the branches of the nopals. The Indian women make use of a squirrel or stag's tail for that purpose; they squat down for hours together beside one plant; and notwithstanding the excessive price of the cochineal, it is to be doubted if this cultivation would be profitable, in countries where the time and labour of man might be turned to account. At Sola, where very cold rains occasionally fall, and where it even frequently freezes in the month of January, the natives preserve the young cochineals by covering the nopals with rush mats. The price of the semilla of *grana fina*, which generally does not amount to more than five francs per pound, frequently rises there to 18 and 20.

In several districts of the province of Oaxaca, they have three cochineal harvests in the year, of which the first (that which gives the semilla) is not lucrative, because the mother preserves for a very short time the colouring juice, if she dies naturally after having laid. This first harvest furnishes the *grana de pastle*, or nest cochineal, so called because the mothers after laying are found in the same nests which have been suspended to the nopals. Near the town of Oaxaca, the cochineal is sown in the month of August; but in the districts of Chontale, this operation does not take place till the month of October; and on the coldest table lands not even till the months of November and December.

The cotton or wild cochineal which gets into the nopaleries, and the male of which, according to the observation of Mr Alzate, is not much smaller than the male of the mealy or fine cochineal, does much injury to the nopals; and accordingly the Indians kill it wherever they find it, though the colour which it yields is very solid and very beautiful. It appears that not only the fruits, but also the green branches of several species of cactus, will dye cotton violet and red, and that the colour of the cochineal is not entirely owing to a process of animalization of the vegetable juices in the body of the insect.

At Nexapa, they reckon that in good years, one pound of semilla of mealy cochineal placed on nopals in the month of October, in the month of January yields a harvest of 12 pounds of mother-cochineals, leaving sufficient semilla on the plant, that is to say, beginning the harvest only when the mothers have already produced the half of their young. This new semilla again produces till the month of May 36 pounds. At Zimatlan and other villages of Misteca and Xicayan, they scarcely reap more than three or four times the quantity of cochineal sown. If the south wind, which is very pernicious to the growth of the insect, has not blown long, and the cochineal is not mixed with *tlasole*, that is to say, with the spoils of the winged males, it loses only two-thirds of its weight when dried in the sun.

The fine and the wild kinds of cochineal appear to contain more of the colouring principle in temperate climates, especially in regions where the mean temperature of the air is 64° and 68° of Fahrenheit. Humboldt found the wild cochineal in abundance in the most opposite climates, in the mountains of Riobamba, at 9513 feet English of absolute elevation, and in the plains of the province of Jaen de Bracomaros, under a burning sky, between the villages of Tomependa and Chamaya.

Around the town of Oaxaca, and especially near Ocotlan, there are plantations (*haciendas*) which contain from 50 to 60,000, planted in lines like pites or *magueys de pulque*. The greatest part of the cochineal which is employed in commerce is, however, produced in small nopaleries belonging to Indians of extreme poverty. The nopal is seldom allowed to grow higher than 47 inches, in order that it may be the more easily cleared of the insects which devour the cochineal. The varieties of the cactus which are roughest and most prickly are even preferred, because these arms serve to protect the cochineal from flying insects; and the flower and fruit are carefully cut, to prevent these insects from depositing their eggs in them.

The Indians who cultivate the cochineal, and who go by the name of *Nopaleros*, especially those who live round the town of Oaxaca, follow a very ancient and a very extraordinary practice, that of *making the cochineal travel*. In that part of the torrid zone, it rains in the plains and vallies from May to October, while in the chain of neighbouring mountains called Sierra de Istepeje, the rains are only frequent from December to April. In place of preserving the insect in the rainy season in the interior of their huts, the Indians place the mother-cochineals, covered with palm leaves, by beds, in baskets made of very flexible claspers. These baskets (*canastos*) are carried by the Indians on their backs as quickly as possible to the mountains of Istepeje, above the village of Santa Catalina, at nine leagues distance from Oaxaca. The mother-cochineals produce their young by the way. On opening the canastos, they are found full of young coccus, which are distributed on the nopals of the sierra. They remain there till the month of October, when the rains cease in the lower regions. The Indians then return to the mountains in quest of the cochineal, for the purpose of replacing it in the nopaleries of Oaxaca. The Mexican in this way withdraws the insects from the pernicious effects of the humidity, in the same manner as the Spaniard travels with his merinos from the cold.

At the time of the harvests, the Indians kill the mother cochineals, which are collected on a wooden plate called *chilcalpetl*, by throwing them into boiling water, or heaping them up by beds in the sun, or placing them on mats in the same ovens of a circular form (*temazcalli*), which are used for vapour and hot air baths. The last of these methods, which is least in use, preserves the whitish powder on the body of the insect, which raises its price at Vera Cruz and Cadiz. Purchasers prefer the white cochineal, because it is less subject to be fraudulently mixed with parcels of gum, wood, maize, and red earth. There exist in Mexico very ancient laws (of the years 1592 and 1594) for the prevention of the falsification of cochineal. Since 1760, they have even been under the necessity of establishing in the town of Oaxaca, a jury of *veadores*, who examine the bags (*zurrones*) previous to their being sent out of the province. They order the cochineal exposed to sale to have the grain separated, that the Indians may not introduce extraneous matter in those agglutinated masses called *bodoques*. But all these means are insufficient to prevent fraud. However, that which is practised in Mexico by the *tiangueros* or *zanganos* (*falcificadores*) is inconsiderable in comparison of that which is practised on this commodity in the ports of the Peninsula, and in the rest of Europe.

The following is a statement of the quantity of cochineal exported at different times.

Quantity of cochineal exported from New Spain by Vera Cruz in 1787, 1788, 1789, *and* 1790.

	Arrobas.	Value in Double Piastres.
First quality, ...	91,346	7,764,469
Second quality, ...	7,973	159,470

Quantity of cochineal exported in the Fleet commanded by Ulloa in 1778.

	Arrobas.	Value in Double Piastres.
First quality, ...	26,400	2,243,203
Second quality, ...	1,052	21,049
In dust, 14 pieces, . .		222

Cochineal exported from Vera Cruz annually, on an average of seven years of peace.

Grana, Granilla, and Polvos de Grana, 4000 zurrones.
Valued at . . . . £504,000 sterling.

See Humboldt's *Political Essay on the Kingdom of New Spain*, vol. iii. and iv. Ulloa's *Voyage to South America*, vol. i. p. 325. Lond. 1807. See also Dyeing and Entomology. (π)

COCHLEARIA, a genus of plants of the class Tetradynamia, and order Siliculosa. See Botany, p. 260.

COCK. See Ornithology.

COCKERMOUTH, a town of England, in the county of Cumberland, is situated a little above the confluence of the river Cocker with the river Derwent. The Cocker separates the upper from the lower parts of the town, which are united by a bridge of one arch. Although the town is irregular, it contains many modern and well built houses. The street which leads to the castle is very steep, and contains several excellent buildings. The street which leads to Derwent bridge, is spacious and elegant, and many of the houses are handsomely built with red freestone. The market house, moot hall, and shambles, are gloomy and inconveniently situated; and the church, which is spacious, was, with the exception of the old tower, rebuilt of freestone, in 1711. The ruins of the castle, which was built soon after the conquest, stood on the top of an artificial mound, raised as a precipice on the banks of the Derwent. The circuit of the wall is about 600 yards, and it appears to have been of a quadrangular form, and guarded by square towers. It commands a beautiful and extensive prospect. There is a public walk, a mile long, on an extensive plain, beneath the Derwent; one end of this walk is terminated by scattered rocks covered with trees, and the other by the ruins of the castle. The principal articles of manufacture here are tanned leather, hats, shalloons, common woollen cloths, checks, and coarse linens.

Inhabited houses in 1811, ...	602
Families that occupy them, ...	709
Families employed in trade, &c.	386
Number of males, ...	1342
Number of females, ...	1622
Total population, ...	2964

(π)

COCOS, a genus of plants of the class Monœcia, and order Hecandria. See Botany, p. 325.

COD. See Fisheries and Ichthyology.

CODIA, a genus of plants of the class Octandria, and order Digynia. See Botany, p. 209.

CODON, a genus of plants of the class Decandria, and order Monogynia. See Botany, p. 213.

CODONIUM, a genus of plants of the class Tetrandria, and order Monogynia. See Botany. p. 152.

COEFFICIENTS. See Algebra.

COFFEA, a genus of plants of the class Pentandria, and order Monogynia. See Botany, p. 150, and Coffee.

COFFEE, is the name given to a liquor, made by a decoction, or an infusion of the seeds of the coffee berry after they have undergone torrefaction, and have been ground to powder.

In treating this subject, we shall first direct the reader's attention to the history of coffee; secondly, to the method of cultivating the coffee plant; thirdly, to the best modes of using it; and, lastly, to a few commercial details of a general nature.

On the History of Coffee.

History of coffee.

The coffee plant does not appear to have been known to the Greeks or Romans, nor are there any facts on which we can rely, respecting its origin in the East. In a manuscript now deposited in the Bibliotheque Nationale, coffee is said to have been introduced into Arabia about the middle of the 15th century, by Megaleddin, Mufti of Ada, who met with it during a journey in Persia. From Ada the use of coffee rapidly extended to Mecca, Medina, and other Arabian towns, and in a short time public coffee houses were every where established in Persia. At Grand Cairo, where it was speedily introduced, the use of it was prohibited in 1511, on the supposition that it produced intoxication, and excited improper feelings. This prohibition, however, was soon removed; but in 1523, when a second attempt was made to prohibit its use, a violent commotion took place in the city, and coffee was ever afterwards drunk with impunity.

A similar opposition was made to the use of coffee in Constantinople. Coal being one of the substances prohibited by Mahomet as unfit for human food, the dervises pretended that roasted coffee must be included in this prohibition, and with the aid of the Mufti, who held the same opinion, all the coffee houses were shut up. Upon the accession of a more liberal Mufti, the coffee houses were again opened; but it was found soon afterwards, that these places of resort were the haunts of the vicious and disaffected, and upon this new plea they were again shut up.

The use of coffee, as a beverage, in the west of Europe, appears to have been known about the end of the 16th century. It was introduced into Marseilles, in 1644, by some gentlemen who accompanied Monsieur De la Haye to Constantinople. Several bales were brought from Egypt to Marseilles, in 1660, and in 1671 a coffee house was opened in that city. Thevenot had already brought a small quantity of it to Paris, in 1657; but it was not generally introduced into that metropolis till 1669, by the ambassador from the Porte; and in 1672, a public coffee house was opened by one Pascal, an Armenian, who afterwards went to London.

Nearly about the same time, coffee was introduced into London. So early as 1652, Danial Edwards, a Turkish merchant, brought with him a Greek servant, who understood the method of roasting and preparing it, and who was the first who sold coffee publicly. In the year 1660, a duty of four pence was laid upon every gallon of coffee; and in 1663 it was enacted, that all coffee houses should take out a licence at the quarter sessions.

We are informed by Boerhaave, in his "Index to the Leyden Garden," that Nicolas Witsen, governor of the Dutch East India Company, instructed Van Hoorn, governor of Batavia, to procure the coffee plant from Mocha, and to cultivate it at Batavia; and that this was accomplished in 1690. Many plants are said to have been raised at that settlement, one of which was sent to Amsterdam, where it bore fruit. From Amsterdam a fine plant was sent to Louis XIV. in 1714, which is said to have been the parent of all that have since been cultivated in the Dutch and the French West India islands. The introduction of the coffee plant into Java is placed much later by Stavorinus, who asserts, that it was first introduced from Mocha into Batavia, in 1722, or 1723, by M. Zwardekrom, the governor general. In 1717, several coffee plants were sent to Martinique. In 1718, they were introduced from Arabia into the Isle of Bourbon, and in the same year into Cayenne, and in 1732 it was cultivated in Jamaica.

In the year 1784, the cultivation of coffee was introduced into the Spanish possessions in eastern Terra Firma, by D. Barthelemy Blandin, who began plantations in the valley of Chacao, within a league of Caraccas. Dr Sligo followed the example of Blandin, and in a short time this new branch of cultivation was adopted in the valley of Aragoa, and throughout all the provinces. In consequence of the war with England, from 1793 to 1801, when the commerce of South America was destroyed by the English cuizers, the culture of cacao, which does not keep for more than ten months, was in a great measure abandoned by the planters, and that of coffee substituted in its room.

On the Cultivation of Coffee.

Cultivation of coffee.

The coffee plant may be advantageously cultivated within 30 leagues of the equator, where the temperature is never lower than 10° or 12° of Reaumur. The soil should be new and free, and a little elevated, so that the tropical heats may be moderated by the rains. Land composed of hard and cold clay, or light and sandy ground on a bed of marl, should be particularly avoided, as it makes the leaves of the plant turn yellow, and the plant itself either perishes, or becomes barren. In Arabia the soil is rocky, dry, and hot, and in Batavia it is rich and deep. The plantation should be exposed as little as possible to the north, and should be protected from the salt air of the sea, which withers the coffee.

Method of planting.

As soon as the land is well cleaned, holes are made for receiving the plant, at such a distance as the planter thinks proper. The plants are generally placed in parallel rows, though it has been suggested as more œconomical to plant them in triangles. It was generally the custom to place the plants at the distance of four or five feet in every kind of soil; but it has now been found from experience, that this distance should be increased when the soil is more fertile, and that in poor lands it should not be less than 4 feet, and never below 8 feet in the most fertile. The depth of the holes should always be increased with the depth of the vegetable mould, the roots never being permitted to penetrate to the stony ground. In St Domingo, M. Bruley, an eminent colonial proprietor, planted coffee grains at 6 inches distance in a quincunx, in soil prepared for that purpose. When the plants were ready to be transplanted, the ground was well watered, so that when the plant was taken up, its roots were surrounded with earth. In this state they were placed in the holes. The effects of the scorching heat of the torrid zone upon the soil, were tempered by heaping flints round the plants, and by this means a freshness was preserved in the soil even in the driest seasons. The plantations which M. Bruley reared in this manner, produced coffee trees; which were handsomer, stronger, and yielded sooner than those of his neighbours.[*]

The young plants should be two feet high before they are taken from the nursery. They must be covered with earth two inches above their roots, and cut at ten inches above the surface of the earth, leaving nothing but the stem. The best season for planting coffee is before the rains, and it is of great importance that the plants should be lopped off at a certain height, depending on the nature of the soil. In the best kind, they should be trimmed at four or five feet from the ground, and in the poorest land at 2½ feet. The planters of Terra Firma, in general, allow only a height of four feet to the plants. There are many, however, who do not trim them at all, and who permit them to attain their full growth, which is about 25 feet.

Weeding.

During the first two years, the coffee plants must be carefully freed from weeds, and this should be done by the hand rather than with the hoe. Other vegetables may be raised, without any disadvantage, between the rows of coffee plants. In the second year, the plants yield a light crop; and in the third year, they are in full bearing. In Terra Firma, each plant yields about 2 pounds of coffee; in Jamaica 1½ pound; and in St Domingo 1 pound. According to Humboldt, each plant yields in a good soil one kilogramme of coffee, and 960 of them may be planted on a hectare of ground. Excepting at the season of blossoming, the plants require much rain, and care must be taken to preserve them from insects and weeds.

Produce.

As soon as the coffee is ripe, it is the custom in Arabia to spread large linen cloths below the trees, which are shaken from time to time, to detach the ripe cherries from the branches. The fruit gathered in this manner is dried in the sun upon mats, which are made to imbibe their moisture. The dry envelope is then removed from the fruit, by means of a large stone cylinder. The fruit is again placed in the sun, till it is completely free of every particle of moisture. It is then winnowed, and packed up in bales.

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[*] See *Memoire sur le Cafier*, read at the public sitting of the Lyceè des Arts, 30th Pluv. 1801.

Gathering of coffee.

The English and French colonists follow a different method from the preceding, in gathering their coffee. As soon as the fruit is of a deep red colour, it is reckoned to be ready for being gathered. A large linen bag, kept open by means of a hoop round its mouth, is suspended to the neck of the negroes, who pull the berries with their hands, and, after filling the bag, empty it into a large basket. A single negro can easily collect three bushels in a day. As the berries do not ripen together, they are collected at three different gatherings. One thousand pounds of good coffee is produced from one hundred bushels of cherries just from the tree. The coffee berries may now be dried in two different ways. The first method is to place them in the sun in layers of four inches thick, on inclined platforms, or sloping terraces. In a few days, the pulp is discharged by fermentation, and in about three weeks the coffee is completely dry. The skin of the berries already broken, is removed by mills, or in wooden mortars. The second method is to separate the grain from the pulp at once by means of a mill, and the grains are then left to soak in water 24 hours. They are afterwards placed in the sun to be completely dried. The grains of coffee are next stripped of the pellicle, or parchment as it is called, by means of appropriate mills, and it is afterwards winnowed, and mingled with the grindings and dust of the parchment, in which state it is put into bags for sale.

Dr Titford[*] is of opinion, that coffee should be sent home in the whole berry, without being divested of its pulp. By this means, he asserts that it will retain its peculiar flavour, and will not imbibe any of the bad flavour of sugar, rum, pimento, &c. with which it is generally shipped.

On the Preparation of Coffee.

Preparation of coffee.

As there is perhaps no process which is so little understood, and so uncertain in its results, as that of making coffee, we had determined to treat this branch of the subject at considerable length, and had collected materials for giving a full account of the various approved methods, which have been founded either on theory or experience; but upon examining the method which has been recently published by Count Rumford in his 18th Essay, we were so much satisfied with its superiority to every other, from the numerous experiments and trials which the Count has made on the subject, that we have no hesitation in giving it as the only method which is worthy of being preserved.

As it is of the utmost importance that every part of the process should be carefully and scrupulously followed, we have preserved as much as possible the very words of the Count.

Count Rumford's method of preparing coffee.

"Great care must be taken not to roast coffee too much. As soon as it has acquired a deep cinnamon colour, it should be taken from the fire and cooled: otherwise much of its aromatic flavour will be dissipated, and its taste will become disagreeably bitter.

In some parts of Italy, coffee is roasted in a thin Florence flask, slightly closed by a loose cork, and held over clear burning coals with continual agitation. No vapour issues from the coffee sufficient to prevent the progress of its roasting from being clearly seen. The Count has adopted this process, by using a thin globular vessel of glass, with a long neck, which he closes, when charged, with a long cork, having a small slit on one side, to allow the escape of the vapours, and projecting far enough out of the neck to be used as a handle to turn the vessel round, while exposed to the heat of a chafing dish of coals. This vessel is laid horizontally, and is supported by its neck so as to be easily turned round; which may be done without the least danger, however near the coals, provided the glass be thin, and kept constantly turned.

Roasting.

In order that the coffee may be perfectly good, and very high flavoured, not more than half a pound of the grain should be roasted at once; for when the quantity is greater, it becomes impossible to regulate the heat so as to be quite certain of a good result. The progress of the operation, and the moment most proper to put an end to it, may be judged and determined with great certainty, not only by the changes which take place in the colour of the grain, but also by the peculiar fragrance which will first begin to be diffused by it when it is nearly roasted enough.

If coffee in powder be not defended from the air, it soon loses its flavour, and becomes of little value; and the liquor is never in such high perfection as when the coffee is made immediately after the grain is roasted. This fact is well known to those who are accustomed to coffee in countries where the use of it is not controlled by the laws; and if a government be seriously disposed to encourage the use of coffee, the Count considers it as indispensable that individuals should be permitted to roast it in their own houses. But as the roasting and grinding of coffee takes up considerable time, the author describes a contrivance of a canister to keep it in, which has a double cover. This vessel is a cylinder of tin, having a sliding piston within, of the same material, formed like the cover of a box, but having several slits in its sides, by which they are sprung outwards, and cause it to retain its place in the cylinder with considerable force. The piston, being pressed down upon the coffee, retains it and defends it from the air, while the same object is more completely secured by a common well fitted cover at top. It may be here remarked—that this kind of canister has the advantage of confining the article without including any air in the same space, except what may be diffused between the particles;—but that, with this exception, a well-corked bottle or other fit vessel may answer the same purpose.

Method of preserving ground coffee.

Boiling hot water extracts from coffee, which has been properly roasted and ground, an aromatic substance of an exquisite flavour, together with a considerable quantity of astringent matter of a bitter, but very agreeable taste; but this aromatic substance, which is supposed to be an oil, is extremely volatile; and is so feebly united to the water, that it escapes into the air with great facility.

If a cup of the very best coffee, prepared in the highest perfection, and boiling hot, be placed on a table in the middle of a room, and suffered to cool, it will, in cooling, fill the room with its fragrance; but the coffee, after having become cold, will be found to have lost a great deal of its flavour. If it be again heated, its taste and flavour will be still farther impaired; and after it has been heated and cooled two or three times, it will be found to be quite vapid and disgusting.

The fragrance diffused through the air is a proof, that the coffee has been deprived of its most volatile parts; and as that liquor is found to have lost its peculiar flavour, and also its exhilarating quality, it is inferred, that both these qualities must undoubtedly depend on the preservation of those volatile parts which so readily escape.

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[*] See the *Transactions of the Society of Arts*, vol. ix.

If the liquid were perfectly at rest, the particles which could escape from its surface would be incomparably less in quantity than would escape by agitation, which would continually present new portions of the fluid to the air. But since all fluids, while heating or cooling, by partial communication, are known to be agitated, the Count endeavours to shew by what means the heat of the liquor may be uniformly kept up in all its parts: for the consequence being, that the parts will, in those circumstances, be at rest, the motions by which the aromatic parts might have been dissipated, will not take place.

By pouring boiling water on the coffee, and surrounding the containing vessel with boiling water, or with the steam of boiling water, the coffee itself will be kept permanently at the same heat, and will not circulate, or be agitated.

The common method of boiling coffee in a coffee pot, is neither economical nor judicious. A large quantity of the material is wasted in this method, and more than half of the aromatic parts, so essential to its good qualities, are lost.

One pound of good Mocha coffee, which, when properly roasted and ground, weighs only fourteen ounces, will make, by proper management, fifty-six full cups of the very best coffee that can be made.

If it be not ground finely, the surfaces of the particles only will be acted upon by the hot water, and the waste will be very great, from the large proportion of coffee left in the grounds.

The size of a coffee cup in England usually answers to 8⅕ cubic inches, but the Count considers the *gill measure* as a proper standard for *a cup of coffee,* which he therefore adopts. This will fill the former cup to seven-eighths of its capacity, and *a quarter of an ounce* of ground coffee will be fully sufficient to make a gill of the most excellent coffee.

It is well known to chemists, that any solvent already in part charged with a substance intended to be taken up, will be less disposed than before to take up any additional quantity; and upon this is founded the process of percolation or straining, as is practised in brewing and other arts, and has been for some time recommended and used in making coffee. To this the Count gives his approbation. He finds, by experience, that the stratum of ground coffee to be laid upon a perforated metallic bottom of a vessel or strainer, ought to be about two-thirds of an inch thick, and to be reduced by pressure by a piston or flat plate of metal (after levelling it) to less than half an inch. From the data he infers, by a chain of observations, that if the height of a cylindrical vessel or strainer be taken constantly at 5½ inches, the diameter of its bottom must be—To make 1 cup of coffee = 1½ inch; 2 cups = 2⅕; 3 or 4 cups = 2¼; 5 or 6 = 3⅕; 7 or 8 = 4; 9 or 10 = 4⅖; 11 or 12 = 5.

These strainers are to be suspended in their reservoirs or vessels for containing the coffee, and the whole included in another vessel called the boiler, which is to contain boiling water kept hot by a lamp, or otherwise. One of the coffee pots recommended by the Count is a porcelain or earthen jug, with a tubular spout, not unlike those which we call milk jugs, except that these commonly have a lip-spout (which would answer nearly as well.) Into the mouth of this is fitted a tin vessel, which fits and descends a little way down. It has a flat bottom perforated with many holes, and a good close cover; and it would be well to have a round plate or rammer, to compress the coffee on its bottom, and defend it from the stream of hot water, when poured in. These several parts are to be dipped in boiling water before using, and the difference between coffee made by this simple and cheap apparatus, of which the mug may also be applied to other uses, and that made by the most perfect machines, will scarcely be distinguishable."

Quantity of coffee exported from different places.

We shall now conclude this article with the following Table, shewing the quantity of coffee exported at different times from Arabia, and the English, French, and Spanish colonies.

		Pounds.	
Cheribon in Java, exported in	1753	1,200,000	
Jaccatra & the Preanger lands	1752	1,200,000	
Ditto do.	1768	4.465,500	
Isle of Bourbon	1768	2,535,100	Raynal.
Surinam exported in	1775	15,387,000	Do.
Martinico		9.688,960	
Guadaloupe		6,302,002	Do.
Cayenne		65,888	Do.
St Domingo exported in .	1767	12,197,977	Do.
Ditto do. in	1775	45,933,941	Do.
Ditto do. in	1783	445,734	quintals.
Ditto do. in	1788	762,865	Do.
Ditto immediately before the French revolution		71,663,187	Edwards.
St Lucia . . . . in	1752	5,000,000	Raynal.
Porto Rico . . . . in	1778	1,116,325	Do.
Grenada . . . . in	1776	1,827.166	Edwards.
Do. . . . . in	1787	987,004	Do.
St Vincent . . . . in	1787	71,041	Do.
Dominica . . . . in	1787	2,032,778	Do.
Do. in favourable years		3,000,000	Do.
Jamaica . . . . in	1768	420,300	Do.
Do. . . . . in	1774	650,700	Do.
Do. . . . . in	1787	716,315	Do.
Do. . . . . in	1790	1,783,740	Do.
Cuba . . . . in	1804	12,000	quintals.
Caraccas . . . . in	1804	5,000	Do.
The Isles of France and Bourbon annually		45,000	Do.
Arabia furnishes annually to the European companies		1,500,000	
Do. . . . . . . Persians		3,500,000	
Do. fleet from Suez		6,500,000	
Do. to Hindostan, the Maldives, and the Arabian colonies on the coast of Africa,		50,000	
Do. to the Caraccas.		1,000,000	
Total from Arabia		12,550,000	

	Quintals.	Value in double piasters.
Imported from the Spanish colonies in America into Mexico, in 1802,	344	6,060
Imported from do. to do. in 1803 . .	474	10,720
Exported from Mexico for Spain in 1802	272	4,360
Quantity produced in eastern Terra Firma, independent of what is used for domestic consumption,	1,000,000 pounds.	

Humboldt computes, that the quantity of coffee annually consumed in Europe is 53 millions of kilogrammes, or 116,971,000 pounds avoirdupois;—that the consumption of France is 230 000 quintals; and that the consumption of Mexico, where the population is one-fifth of that of France, is only 400 or 500 quintals.

For farther information on this subject, see Ellis's *History of Coffee.* Cadet de Vaux *on the History and Properties of Coffee* in the *Journal de Physique*, vol. lxiii. p. 216. Sept. 1806. or in Nicholson's *Journal*, vol. xvii. p. 118. Chenevix *on a peculiar vegetable principle in Coffee*, in Nicholson's *Journal*, vol. ii. p. 114. Raynal's *History of European Settlements.* Bruce's *Travels.* Edward's *History of the West India Islands.* Cordiner's *Description of Ceylon*, vol. i. p. 379. Valentia's *Travels*, vol. ii. p. 363. Stavorinus's *Voyages*, vol. iii. p. 328. Humboldt's *Political Essay on New Spain*, vol. iii. p. 22. Count Rumford's 18th *Essay;* the article Arabia, Vol. II. p. 286, 287; and the article Colony. (w)

COFFERDAM. See Bridge, Vol. IV. p. 523.

COHESION of Fluids. See Adhesion, Capillary Attraction, and Hydrodynamics.

COHESION of Timber. See Carpentry, Vol. V. p. 496, &c.

COHESION of the Metals. See Chemistry, Vol. VI. p. 30. Sect. 28.

COIMBRA, a city of some importance in Portugal, about 31 leagues from Lisbon. The situation of Coimbra is extremely delightful. The surrounding country, though mountainous, is fertile and highly cultivated. The mountains, covered with groves of pines and German oaks, embosom vallies of exquisite beauty, where elegant quintas, and neat summer-houses, are finely contrasted with the stately solemnity of the monastery; and where brooks, flowing through luxuriant gardens, or gleaming amidst the shades of olive-trees, orange-trees, and the beautiful Portuguese cypress, give freshness and animation to the scene. From one of these vallies, through which the Mondego rolls his broad and winding stream, Coimbra rises along the declivity of a hill, bursting at once on the view of the traveller, in all the magnificence of spires, churches, and monasteries. Opposite to Coimbra, in the romantic valley of the Mondego, is the *quinta das lagrimas*, or garden of tears; a spot "over which fancy delights to hover." The view is closed by the lofty mountains of Lousao on one side; and on the other, by the mountain of Bussaco, whose solitary summit is adorned with a celebrated monastery of Carmelites, and its quinta with high shady cypresses.

On entering the town, however, the agreeable feelings and expectations which its situation and distant appearance had excited, are suddenly exchanged for disappointment and disgust. It seems to have been built in meditated defiance of all the rules of convenience and taste. Its streets are extremely narrow, crooked, full of angles, ill paved, and dirty; and frequently so steep that they cannot be climbed without difficulty and toil. The only broad street is in that small part of the town which is situated on the plain; but even that street, as it is deemed unhealthy in summer, is the residence only of the poorer class of citizens. Here are no open spaces, or promenades, so necessary to the health and comfort of the inhabitants in that warm climate. The only resort of the citizens in their pleasure walks is to the great quinta of the Augustines, a spot which all should visit who wish to see the Indian laurels from Goa growing in their greatest perfection. In addition to all these inconveniences, the inns are so bad, their apartments and beds so wretched, and the victuals so execrably dressed, as to give constant exercise to the Christian virtues of patience and self-denial.

Coimbra is a place of great antiquity, and had sustained many sieges before Count Henriquez took possession of Portugal. The ancient walls and towers still remain, and form the only defence of the city. Since the year 1419, it has been in a state of decline. Even yet, however, it contains more than 3000 houses, is divided into eight parishes, and has no less than eight monasteries and eighteen endowments. It is the see of a bishop who is always Count of Arganuil; and has its corregidor, its provedor, and juiz de fora, or court of justice.

By far the most important object at Coimbra is the university, founded at Lisbon by Don Diniz in 1291, but transferred hither after a period of sixteen years. It was again removed to Lisbon; but in 1537 was a second time transferred by John III. to Coimbra, where it has since remained. This university is under the government of a rector nominated by the king. The office of rector, which is never conferred on a member of the university, is triennial; and is generally held by a priest, who, after the term of his rectorship has expired, is either reelected, or promoted to a bishop's see. Superior to the rector is the reformator; but both these offices are frequently united in one person. A *concello dos deoanos*, consisting of the dean of faculty, two fiscals (the conservador and ouvidor) and the secretary, with the rector as president, has the supreme jurisdiction over the concerns of the university. The pecuniary and property transactions of this rich establishment are managed by an auxiliary council of finance, (*juncta de fazenda*) consisting of a professor of theology, a professor of law, the professor of calculation, with a treasurer and clerk. The prior and chief of the Augustine canons regular at Coimbra is *ex officio* chancellor of the university. He is the principal superintendant in matters of learning, conferring the degrees at all promotions, and presiding at the examinations of students. In this university the degrees are very numerous; and, if the division of labour be sufficient to ensure excellence, the professors of Coimbra ought to be particularly eminent. The field of study is here divided into six departments, theology, canon law, jurisprudence, medicine, mathematics, and philosophy. In the first department there are are eight chairs; in the second, nine; in the third, eight; in the fourth, six; in the fifth, four; and four in the sixth. In the department of philosophy, neither logic nor metaphysics have obtained a place; the four chairs being occupied by a professor of zoology and mineralogy, a professor of experimental philosophy, a professor of chemistry, and a professor of botany and economy. Of all the sciences purely philosophical, the law of nature alone is taught by a *professor canonum.*

The session commences in October, and closes in May; after which the public examinations, to which all must submit, continue till the month of July. These examinations are carried on in the Portuguese language; but are so severe that many of the students, rather than submit to them, relinquish the university. The lectures are likewise delivered in Portuguese; and in all respects resemble those delivered in other universities except that the students pay nothing for hearing them. Before a student, whether in theology, jurisprudence, or medicine, can hold a place or exercise his profession, he must have studied at Coimbra a certain number of years, attended certain lectures, and gone through his annual examinations. The term prescribed for physicians is five years; but only those take a doctor's degree, who wish to become tutors at the university, in which case they must dispute publicly, but write no inaugural dissertation. Hence the title of doctor is very uncommon, and of course highly honourable. The degrees of bachelor or master of arts are now seldom conferred. The number of students at Coimbra is very considerable. When Link was there, in 1798, he was told that it exceeded 800; though some Portuguese writers make their number amount to 2000, and others even to 8000. The students are distinguished by a particular dress, but live, as with us, in private houses, and not within the walls of the university.

The museum contains few remarkable specimens; but the collection of philosophical instruments is excellent, containing many of English manufacture, entirely new. In mechanics it is very rich, but extremely poor in electrical apparatus. The chemical laboratory is capacious, and well furnished; containing, besides the objects generally found in such establishments, a pneumatic apparatus, and a collection of chemical preparations according to the new nomenclature: it is likewise provided with a collection of chirurgical instruments. In the library the number of volumes is considerable, comprising many of the most valuable modern publications. The observatory, which stands in an excellent situation in the upper end of the town, is very convenient and neatly arranged; but very deficient in instruments. The botanic garden, though not large, is admirably regulated, forming almost an exact counterpart to the garden of Paris. Besides many exotics, it contains a considerable number of plants indigenous in Portugal. In short, the institutions in the university of Coimbra are far from being contemptible; nor are its professors deficient either in genius or learning. But the difficulty and the danger of publishing, in a country where every work must be printed at the expence of the author, without any prospect of recompence, and where the inquisition reigns in all its terror, repress all their exertions, and retard the progress of literature and science. West Long. 8° 23′ 45″, North Lat. 40° 12′ 30″. See Link's *Travels in Portugal*. (*k*)

COIN. See BULLION, CURRENCY, and MONEY.

COINING MACHINERY.

COINING, is the art of making metal money, by impressing on its surface such marks as will, at first sight, identify it to be the legal coin, issued by the government of the country where it is current. The impression should be so executed as not to be easily effaced by use, or imitated by counterfeits, and that it should not admit of any reduction from the coin without evidently disfiguring it.

Of hammer money.

Coining press.

Coining among the ancients, and indeed by the moderns, till within these 250 years, appears to have been very rudely and imperfectly performed, by placing the blank piece of money between two dies, or steel punches, containing the design of the coin, and striking upon the upper one with a hammer. This, which is called hammer money, is alway imperfect, from the uncertainty of placing the two dies exactly over each other, when the blank money is between them; and also from the improbability of a man being able to strike a blow with such force as to make all parts of the impression equally perfect. The hammer money continued to be current in England, until the reign of William III. although the more perfect method of coining, by the mill or press, was introduced from France, in the reign of Queen Elizabeth, as early as 1562. The mill did not continue in practice more than 10 years, when the hammer coinage was resumed as being less expensive. Before the hammer money was called in by William III. the English money was in a most wretched condition, having been filed and clipped by natives, as well as foreigners, until it had lost nearly half its value. The milling upon the edges of coins was introduced about this period, (William III.) and such confidence was then placed in this new device, that it was deemed impossible for the coin to be diminished, by clipping or wearing. It was, however, soon discovered, that milled money, either of gold or silver, could be diminished with great facility and expedition, by a process termed *sweating*, which was effected by disolving a portion from the whole surface of the coin, by an acid, without leaving any evident marks of the fraud. The money was also filed on the edge, and a new milling afterwards impressed upon it, by methods which were soon discovered, notwithstanding the great caution taken by the government to keep the process of milling a profound secret.

Invention of the press.

The coining press, or mill, is of French origin, and is generally ascribed to Antonie Brucher, an engraver, who, in 1553, first tried it in the French king's (Henry II.) palace, at Paris, for the coining of counters. It continued in use till 1585, in the reign of Henry III. when it was laid aside on account of its being a more expensive method than the hammer coinage. Queen Elizabeth, as we before stated, had a coining press very soon after its first invention, but she soon gave it up for the same reason as the French did. The machine remained in disuse untill 1623, when Briot, a French artist, who was unable to persuade the French government to adopt it again, came to England, where it was immediately put in practice under Briot's direction, who was appointed chief engraver of the mint. Like most other new inventions, it was sometimes used, then laid by, and the hammer resumed during a period of 40 years. But under Charles II., in 1662, the use of the press was completely established in the English mint, as it had been by the French, in 1645; and from the improvement it has made in the neatness and perfection of the coins struck by it, there is no danger of its ever again falling into disuse, especially as the admirable improvements made in it by the late Mathew Boulton, Esq. have rendered it the cheapest possible method, as well as the most perfect. These improvements, which we intend to describe in this article, have been adopted by England, Denmark and Russia, after having being long used at Mr Boulton's works, at Soho, in coining copper, by contract, for many of the governments in Europe; for the East India Company, and the Americans. By their steam engines, they work the presses for cutting out the circular pieces of metal, and afterwards by other presses both faces at once, with such superiority of execution, and cheapness of workmanship, as will greatly prevent clandestine imitation. By this machinery, four boys are capable of striking 20,000 pieces of money in an hour, and the machine acts at the same time as a register, keeping an unerring account of the number of pieces struck.

Old method of coining in the Tower.

The coinage of England, from the time of William the Conqueror until 1811, was wholly carried on, in the Tower of London, by a corporation, under the title of the Mint, consisting of a number of officers, each having their respective duties in the different processes of the coinage. The artizans or workmen were called the Company of Moneyers, and did the work by contract. See MINT.

They employed four kinds of machines; 1st, The rolling mill for laminating the metal to plates of a proper thickness; The cutting out machine, for punching circular pieces from the plates, of the proper size to form the coin; 3d, The machine for milling on the edges; and 4th, The coining press for stamping the impression on both sides at once.

Casting the ingots.

Laminating.

Cutting out blanks.

Plate CCI, Fig. 6.

The first operation is the mixing of the metal, because there is no coin of pure gold or silver, a quantity of copper or alloy being always mixed with them, to render the coin harder, and less liable to be diminished by fraud. When the metal is mixed in crucibles, and melted in an air furnace, it is cast into long flat bars or ingots, by the same methods as are used by founders in sand, both with regard to the frames, the manner of working the earth, and the use of the models or patterns. These patterns are flat plates of copper about fifteen inches long, and nearly the thickness of the coin to be struck. The bars or ingots, when taken out of the moulds, have the sand scraped and brushed off; and are passed several times through the rollers of the mill, to flatten and bring them to the just thickness of the specie to be coined. Before the ingots of gold are passed through the mill, they are *annealed*, that is, they are heated red in a furnace, and plunged in water, to soften and render the metal more ductile. The silver ingots pass through the mill, just as they are, without any annealing, but are afterwards put into the furnace and left to cool gradually. The plates, whether silver, gold, or copper, being thus reduced as near as possible to their thickness, are cut into round pieces called blanks or planchets, very near the size of the intended specie. This is done with a machine similar to that called by mechanics, a fly press; see Fig. 6. Plate CCI. It consists of a proper iron frame AA, supporting a perpendicular screw B, which has a handle C at the top to work it by, and at the lower end is a cylindrical steel punch *a*, of exactly the same size as the pieces intended to cut out. When it is depressed by the screw, this punch or cutter enters a hole made in a steel dye or bed *b*, which hole is exactly the size of the punch. The slip of plate D being placed over this hole, and the screw turned by its handle, forces the punch through the plate, carrying a round piece with it. The workman guides the plate D with one hand and works the screw C with the other, so as to cut out the pieces with great rapidity.

Adjusting.

These pieces are now given to proper officers to be adjusted, and brought by filing the edges to the weight of the standard, whereby they are to be regulated: the remainder of the plate between the circles is melted again under the denomination of *sizel*. The pieces are adjusted in a fine balance; and those which prove too light are separated from those which are too heavy, the first to be melted again, and the second to be filed down; for the rollers of the flatting mill, by which the plates are reduced, are never so exact, but there will be some inequality in the thickness, causing a difference in the blanks, which inequality may indeed be owing to the quality of the matter, as well as of the machine, some parts being more porous than others.

Blanching.

Milling the edges.

Plate CCI Fig. 7.

When the blanks are adjusted, they are carried to the blanching or whitening house, where they have their colour given them; and the silver ones are whitened, which is done by heating them in a furnace, to anneal and soften the metal, and when taken out and cooled, they are boiled successively in two copper vessels with water, containing common salt and tartar, and after that they are scoured well with sand, and washed with common water, then dried over a wood fire in a copper sieve, into which they are put when taken out of the boilers. The planchets are now marked with letters, or graining on the edge, to prevent the clipping and paring of the specie, which is one of the ways wherein the ancient money used to be damaged. The method of performing this operation, in the English mint, is by its very constitution kept a profound secret; but is shewn publicly in the mints of foreign countries. The machine, used by them, for marking, or milling the edges, is very simple, yet ingenious; see Plate CCI. Fig. 7. It consists of two plates of steel, *aa* and *bb* in the form of rulers, and about the same thickness as the coin. On the adjacent edges of these the legend or edging is engraved, half on the one, and half on the other. One of these rulers *aa* is immoveable, being strongly bound with clamps to a copper plate *dd*, and that again is fixed to a strong board or table AA. The other plate *bb* is moveable in the direction of its length, and slides on the copper plate *dd*, by means of a handle B, and a pinion D; the teeth of which catch into the teeth of a rack *ee*, attached to the moving ruler *bb*. The distance between the edges of the two rulers is made to correspond with the diameter of the money, by advancing the immoveable ruler towards the other by two screws *f*, *f*. Now the blank being placed horizontally between these two rulers, is carried along by the motion of the moveable one, so that by the time the handle B has made half a turn, it is found marked all round. The Figure shews that the machine will do two blanks at once.

This machine is so easily wrought, that a single man is able to mill twenty thousand blanks in a day. Savary says it was invented by the Sieur Castagin, engineer to the French king, and first used in 1685. But it is certain we had the art of lettering the edges in England long before that time. Witness the crowns and half crowns of Oliver Cromwell, struck in 1658, which, for beauty and perfection, far exceed any French coins we have ever seen.

Coining b the press.

Plate CC Fig. 8.

The planchets being thus prepared, are to be stamped in the coining press, shewn in Fig. 8. of Plate CCI. This machine has a massive iron frame, consisting of two upright sides or cheeks, AA, united by cross pieces or sills, B and C, at top and at bottom. Through the top piece B, a strong perpendicular screw D works in the center of the frame, and actuates the upper die or steel matrix *a*, on which the impression of the coin is engraved or sunk; this die is fixed in a square slider E, moving in collars *b*, *b*, attached to the frame A, so that it merely rises and falls by the movement of the screw, without turning round. The lower die *c*, is fixed in the center of the bottom sill C of the press, being held in a box furnished with screws to adjust it immediately beneath the upper one. The press is wrought by four men. The screw D has a lever, or pair of arms F, F, fixed on the top of it, called by the French *balancier* or fly, from being loaded at the ends with heavy weights *d*, *d*; and the men pull by ropes or straps G, G and H, H, fastened at the ends of these arms; another person sits in a hole in the floor before the press, and places the blanks, one by one, upon the lower die *c*, then the two men, by the ropes GG, give a sudden motion to the arms of the fly *dd*, which turning the screw D, presses the upper die upon the money with sufficient force to give it the impression, the momentum acquired by the motion of the weights of the fly giving it a very great power. The recoil of the press, aided by the two workmen who hold the two shafts HH, returns the arms of the fly; then the person beneath puts in another blank, which is struck as before, and in this manner the operation proceeds very rapidly. The blanks having now all their marks and impressions, both on the edges and faces, become money; but they have not currency till they have been weighed and examined by proper officers belonging to the establishment.

The new Mint.

Mr Boulton's inventions.

In 1811, the Royal Mint was removed from the Tower of London to a very magnificent building erected for the purpose on the east side of Tower-hill, from the designs of Mr Johnson, architect. The system of coining by machinery, practised in this new establishment, was, in great part, invented by the late Matthew Boulton, Esq. His original apparatus was erected at his celebrated works at Soho, near Birmingham, in 1788 and 1789, and was first employed in coining for the East India Company, and some of the earliest copper coins issued by the French republic. The beauty of the coins which he produced, occasioned him to be employed by contract by our government, to coin the new copper issued in 1797. Since this period, he has recoined an immense number of Spanish dollars, without remelting them; also copper for the East India Company, and several foreign governments; which shewed the advantage of the invention to be so great, that the governments of Russia and Denmark, each procured a complete series of machines from Mr Boulton, under the sanction of acts of Parliament, and erected them in their Mints at Petersburgh and Copenhagen. In the new Mint erected on Tower-hill, a complete set of Mr Boulton's machines have been at work since 1811, with great success.

Plates of the machinery.

Knowing that it would be highly interesting to our readers, we have obtained a series of drawings of these machines, which are contained in Plates CC. CCI. CCII.

Pouring machine.

Plate CC. Figs. 1, 2, 3, 4, and 5.

The first of these, at Figs. 1, 2, 3, 4, and 5, contains drawings of the crane, and pouring machine which lifts the melting pots out of the furnace, and pours their contents into the ingot moulds.

Rollers.

Figs. 6 & 7.

Circular shears.

Plate CCI. Fig. 4.

Figs. 1, 2, and 3.

Coining press.

Figs. 6 and 7, are the laminating rollers, used for flattening out the ingots into plates of the proper thickness: these plates are cut into narrow slips by the circular shears shewn in Plate CCI. at Fig. 4. The strips are afterwards rolled again, to reduce them to the exact thickness of the intended coin. From these plates circular pieces of blanks are cut out by the machinery represented in Figs. 1, 2, and 3; and after being properly blanched and scoured, have their impressions struck in the press represented in Plate CCII.

Melting.

Plate CC. Fig. 1.

Crane.

The furnaces in which the metal is melted, are eight in number, and are so arranged on opposite sides of the melting-house, in two rows of four in each, that the crane, represented in Fig. 1, Plate CC. being placed in the centre between four, will, by turning round upon its center, come over the center of any one of the furnaces, and will lift a pot of melted metal from any one of the four; therefore, two cranes so situated, will command the whole. The crane consists of a vertical column AB, fixed firmly in the ground with a flanch at its base; round this the gib C, D, E swings, being united by two collars at C and E, so as to swing freely all round; *e* is a frame of iron, bolted to the gib to support the pivots of the roller or barrel *f*, and also the axis of the pinion *g*, which works the cog-wheel *h* on the end of the barrel; the chain from the barrel passes over the pulley F fixed at the top of the gib, immediately over the center of the column, and thence proceeds to the pulley D at the extremity of the gib. The frame *e* also supports a third axis *i*, having an endless screw upon it, acting in the teeth of a wheel, fixed upon the main column, so that by turning the winch *k* at the end of this spindle, the whole crane is turned round on its axis. At the extremity of the chain, a pair of tongs G are suspended, the claws of which take hold of two projecting ears of the melting pot, and then it is lifted out of the furnace by turning the handle of the pinion *g*; then by turning the winch *k*, the crane is swung round, and the pot is conducted to the pouring machine.

Pouring machine.

Plate CC. Figs. 5.

Ingot moulds.

Fig. 4.

This machine has an iron frame HH erected from the floor, to support the two pivots *l* of a frame or cradle which receives the melting pot I, and on which pivots it can be inclined by means of an arch K and proper wheel work, so as to pour its contents into the ingot moulds, which are placed in a carriage L, (shewn separately in Fig. 5). The cradle for the melting pot is composed of an axis *e* on which it swings; a bar *m* proceeding from it, and having the rack K fixed to it at the lower end; also an iron hoop *n*, which embraces the pot round the neck, and has two bars *o* proceeding one on each side to the lower end. The hoop *n*, as well as the latter bars, are united to the axis and the bar *m* by hinges, so that they will open out to receive the pot, but being drawn together by a screw in the hoop at *n*, hold it quite fast: The teeth of the rack K are engaged by a pinion *p*, situated on an axis which goes across the frame, and receives its motion, by equal bevel wheels, from an axis *q*, which is moved by means of equal bevel wheels upon the end of a third axis, parallel with the first; at its opposite extremity this carries a wheel *r*, which is turned by a pinion *s* having a handle at the extremity of its axis. The object of this train of wheels is, that by turning the handle of the pinion *s*, the workman will be able to incline the rack and melting pot with a very gradual motion, to empty its contents into the moulds. The ingot moulds are made of cast iron, as shewn in Fig. 4, each in two separate halves A, B, having flat surfaces A, B to form the body of the ingot, and rising edges *ab* composing the sides of the mould; one of the halves has also a similar rise *c* to make the bottom, so that two halves, when put together, form a proper cavity or mould to cast an ingot, as is shewn in Figure 1, which represents the two halves put together ready for casting.

Fig. 2.

Fig. 3.

Fig. 1.

Figs. 2 & 3.

Fig. 1.

Fig. 3.

The moulds are set up, a great many of them together, in an iron frame mounted on a carriage, shewn sidewise in Fig. 2, and endwise in Fig. 3. The carriage is an iron plate LL, moving on four wheels, and having the iron frame MM, NN for the moulds upon it. This frame has two screws *tt* at each end, which being forced up against the moulds P, placed in the frame, hold them all together and in their places, so as to make all the joints tight; they rest upon an iron plate, suspended by two screws *vv*, by which it can be elevated or depressed at pleasure, to suit moulds of different sizes. The carriage runs upon a railway laid across the floor of the melting-house, so as to bring it beneath the pouring machine, as represented in Fig. 1. In this situation, a rack *w*, Figs. 2 and 3, which is fixed to the carriage by small columns, comes where its teeth will engage with a wheel *x*, Fig. 1: This is turned round by a pinion, carrying the handle *y* on the end of its spindle; and therefore by turning this, the wheel *x* communicates a gradual and regular motion to the carriage, bringing the moulds, one by one, beneath the lip of the melting pot to be filled with metal. The distance of the moulds from the pot, can be regulated at pleasure by shifting the frame MN sidewise upon the carriage, which is done by means of a screw at each end, as shewn at W, Fig. 3.

Furnaces.

The furnaces in which the metal is melted are extremely well contrived, having the flues for the draught into the chimney proceeding from three different sides towards the top, instead of going altogether from one side, as in common air furnaces, by which means the heat is much more regular, and has not so much tendency to burn away in the throat or flue, as if it were single.

Melting pots.
Plate CC.
Fig. 5.
Melting.

The melting pots, Fig. 5, are made of cast-iron, and of sufficient capacity to hold 400lbs. of metal. They have each a lip or spout *a*, at which the metal is poured out, and two ears *b*, *c*, by which they are taken up with the tongs of the crane, as before described, and lifted into the furnaces. The pot is supported by proper pedestals from the grate of the furnace, and has a large ring of cast iron placed on the top of it to prevent the fuel from falling into it: As soon as it arrives at a red heat, the metal, properly prepared and mixed, is put in, and occasionally stirred up while it is melting, which takes some hours. The moulds, in this interval, are prepared by warming them in a stove, and when they are taken out to be placed in the frame upon the carriage, the inside surfaces are severally rubbed with a cloth dipped in oil, which preparation, as well as the heating, is found to give the ingot a better surface. When the proper number of moulds are placed in the carriage, as shewn in Fig. 2, the screws *t*, *t* at the ends, are screwed fast to fix them all tight; and in this state they are prepared for casting.

Fig. 2.

Casting.
Fig. 1.
Assay.

The pot of metal, as before mentioned, is lifted out of the furnace by the crane, then swung round, and lowered down into the cradle *lmno* of the pouring machine, until the ring on the edge of it rests on the iron hoop *n*, which being screwed up tight, holds it fast, and the tongs of the crane are disengaged. One of the attendants now takes the handle *s* in one hand, and *y* in the other; and by turning the latter of these he advances the carriage forwards to bring the first mould beneath the lip of the melting pot, then by turning the other he inclines the pot, and pours the metal into the mould; when this is full, the second is brought beneath it, and so on in succession. The whole four hundred weight is very quickly cast into ingots without any loss or waste, which could scarcely be avoided in any other way of casting. The first metal which is poured from the pot is received in a small iron spoon, and is reserved for the assay master, who examines its quality, and it is not allowed to pass through the succeeding processes, until, from this specimen, he has ascertained it to be standard. A second sample is taken from the middle of the pot, and a third from the last of it. The pouring machine was, we understand, invented by Mr Morrison, an officer of the Mint.

Rolling mill.
Plate CC.
Figs. 6 & 7.
Fig. 6.

The ingots thus cast are about 10 inches long, 7 broad, and 6 tenths of an inch thick. They are next carried to the rolling mill, which is represented in Figs. 6. and 7. in Plate CC. In the former, A represents a large cog wheel, fixed on the extremity of a long horizontal shaft BB, extending beneath the whole mill: This wheel and shaft receive their motion from a smaller wheel, fixed on the main or flay wheel shaft of steam engine of 36 horse power. The main shaft B of the rolling mill has wheels C, D, E fixed upon it, to give motion to the respective rollers, which are mounted at F and G, in strong iron frames bolted to the iron sills *a a*, which extend through the whole length of the mill, and rest upon the masonry, in which the wheels are concealed. The two large wheels C and E give motion to the wheels H, I, which are supported on bearings between two standards *b b* bolted down to the ground sills; as is also shewn at *b b* in the perspective view, Fig. 6. On the ends of the axes of these wheels are heads for the reception of coupling boxes *d d*, which unite them to short connecting shafts K, L; and these again, by means of coupling boxes, convey motion to the upper rollers *ee* of each pair, at F and G. The middle wheel D upon the main shaft B gives motion to the lower rollers in a similar manner thus: It turns the wheel M, by means of an intermediate wheel, not shewn in the Figures. This at each end of its axis, gives motion to the lower rollers FF by the connecting shaft *g g*. By this ingenious arrangement, both the rollers *e*, *f* of each frame, receive their motion from the main shaft with equal velocity, and by means of wheels of large radius, which act with much more certainty than the small pinions usually employed in rolling mills, to connect the upper and lower rollers, and cause them to move together. The wheel M, in consequence of its intermediate wheel, revolves in a contrary direction to the wheels H, I; but all the pairs of wheels being of equal diameters, and having the same numbers of teeth, they revolve in precisely the same period; and the two rollers *e*, *f* being of the same diameter, their surfaces accompany each other, without which the metal rolled between them would be buckled; that is, one side being more expanded than the other, would render the plate convex. The connecting shafts K, L and *g g*, and coupling boxes *d d*, which give motion to the rollers, have sufficient play in their joints, to allow that small deviation which takes place, when the rollers are set nearer together for reducing the plate to its intended thickness. The detail respecting the frame, and parts of the rollers, is explained by the perspective view, Fig. 7. in which *a* represents one of the sills before mentioned, which runs through the whole length of the mill; upon these are bolted the two cheeks, or side frames of the rollers, marked NN: Each of these has a large mortise, or opening in it, to receive the bearings for the necks or gudgeons of the rollers *e f*, between which the metal is passed. Their distance from each other, and consequently the thickness of the rolled plate, is regulated by two strong screws OO, passing through the upper part of the cheeks of the frame, and their points pressing upon the bearings PP, or the pivots of the upper roller. The weight of the roller is suspended by two bolts, passing through the frame, and they are united to a collar Q, which is fitted on the upper end of the screws; and this collar being a long plate, is common to both screws, as the Figure shews. Immediately above this plate, the screws have wheels RR fitted upon them, which are cut with teeth on the lower part of them, to receive motion from two endless screws, formed upon a spindle SS, which moves in bearings projecting from the plate Q. By turning this spindle, its endless screws act upon the wheels RR, to turn them round; and the great screws partaking of the same motion, elevate or depress the upper roller *e*, with so delicate a movement, that it can be adjusted to roll the plate to the greatest nicety; and the adjustment being made at both ends at the same time, the two rollers always preserve their parallelism. The metal, when introduced to the rollers, is placed upon a small table V, fixed between the frames NN. Its upper surface being exactly level with the top of the lower rollers, it is fastened by means of a cross bar T, and wedges which press it fast up against projecting pieces of the frames.

Plate CC.
Fig. 6.
Fig. 7.

The cheeks NN of the frame, are connected by strong wrought iron bolts, which are too plainly shewn in the figure to require any particular description.

Fig. 6.

The rolling mill contains four pair of rollers, each driven by its train of wheel work as shewn in Fig. 6; the mill therefore consists of two such sets of wheels and rollers, as are represented in Fig. 6. The two shafts are situated parallel to each other, and receive their motion from the same steam engine; the wheel before mentioned, which is on the main axis of it, being situated between them, and giving motion to one of the main wheels AA on each side. The whole machine forms the most complete rolling mill we have ever seen, and the workmanship of it is unrivalled: It was executed by the celebrated engineer John Rennie, Esq.

Operation of rolling.

Circular shears.

PLATE CCI. Fig. 4.

Fig. 5.

Fig. 4.

Fig. 5.

Adjusting rollers.

PLATE CC. Fig. 8.

Gauge.

The ingots of silver are heated to redness in a furnace before they are rolled. The two furnaces for this purpose are situated before two pair of rollers, which are therefore termed breaking down rollers, being used to consolidate the metal by rolling whilst hot. In the operation, two men are employed; one takes the metal from the furnace by a pair of tongs, and introduces it between the rollers; the other catches it as it comes through, and lifting it over the top roller, returns it to the first, who puts it through again, having previously turned the handle S a small quantity, to set the rollers nearer together. After having been rolled in this manner four or five times, they are reduced to near two-tenths of an inch in thickness, and increased in length to about four times the breadth of the ingot; for it should be observed, that the ingots are rolled across their breadth, the longest side being presented to the rollers; and as the rollers do not extend the plate sidewise, the plates, when finished, are as broad as the length of the ingots, viz. 10 inches, and three or four times as long as the breadth of the ingot, *i. e.* from 21 to 28 inches. These plates, whilst still warm, are rubbed over with a weak solution of acid or *pickle*, to remove the colour produced by the heat, and are then cut up into narrow slips across the breadth of the plate, by means of the circular shears, Fig. 4. Plate CCI. This machine is worked by a cog wheel at the extremity of the main shaft B, Fig. 6. of the rolling mill. It consists of a framing of iron AA, supporting two shafts BB, which are parallel to each other, and move together by means of two equal cog wheels CC, the lower one of which works with the teeth of the great wheel above mentioned, upon the main shaft of the rolling mill. At the extremities of the two shafts, wheels or circular cutters are fixed, their edges overlapping each other a small quantity, as is shewn in the edge view Fig. 5. Here it is seen that each cutter has a rim of smaller diameter than the outside: this small rim in the top cutter is behind it at *e*, but is in front of the lower one at *g*, so that the adjacent edges of the large rims *f* and *k* come in contact, and overlap each other a small quantity. By this means they act in the same manner as shears, to cut any thing, as *c*, *d*, which is interposed between them, by depressing one half *d*, and elevating the other *c*, till they are completely separated. F, Fig. 4, represents a shelf on which the plate is laid, and advanced forwards to present it to the cutter; and G is a ledge or guide, screwed down upon it, to guide the metal, and, by its distance behind the planes of the cutters, to regulate the breadth of the piece which shall be cut off; for this purpose the screws which fasten down the ledge are fitted in oblong holes, which admit of small adjustment. The workman holds the plate flat down upon the surface F, and advancing it towards the shears, they will continue to draw it through, when they once take hold, until they have cut the whole length. *c d*, Fig. 5. shews a section of the plate to explain the manner in which it is cut: The part *c* is conveyed upon the top of the rim *k* of the lower cutter, and kept down from rising by the small diameter *e* of the upper cutter; at the same time, the other part of the plate is depressed by the rim *f* of the upper cutter, and supported by the small rim *g* of the lower one. By this means, the divided parts *c* and *d* are prevented from curling up into scrolls, as they will, when cut in a common pair of shears, because the small parts *e* and *g* keep them straight. Behind the standard, supporting the back pivots of the shafts BB of the cutter, is a frame *l*, with a screw *m* tapped through it. This is used to draw the axis of the upper cutter D endwise, and keep its edge in close contact with the edge of the other cutter E. The slips of plate are now carried to the other two pair of rollers in the rolling mill, which are made of case-hardened iron, and with a better polish on their surface than the breaking down rollers. The plates are passed cold between these, to bring them exactly to the requisite thickness; hence they are called the adjusting or planishing rollers. The workman here tries every piece as it comes through by the gauge Fig. 8. This is a piece of steel, having a notch in it, the inside lines of which are very straight, and inclined to each other at a very acute angle. They are divided, as is shewn in the Figure, so that the edge of the plate being pressed into the notch, will have its exact thickness determined by the distance it will go into it, the divisions shewing the dimensions in parts of an inch.

PLATE CCI. Fig. 6.

In rolling the plate the second time, they pass all the slips successively through the rollers, then adjust the rollers by the handle, and pass them all through a second time. This is repeated three or four times, and the last time they are every one tried by the gauge, and sorted by it into as many parcels as they find different thicknesses; for it is a curious fact, that though the rollers are 14 inches in diameter, and the frame proportionally strong, still they will yield, in some degree, so as to reduce a thick plate in a less degree than a thin one; and the plates which have all passed through the same rollers will be of three or four different thicknesses, which being sorted by the gauge into as many parcels, they begin to reduce them to the exact quantity, by setting the roller according to each parcel: then the first of the parcel which comes through is tried, by cutting out a circular piece with a small hand machine, Fig. 6. Plate CCI. and weighing it: If it proves too light or too heavy, the rollers are adjusted accordingly, till, by a few trials, they are got right, and then all the parcel is rolled through. The next parcel is then tried, and so on; the trial plates which are too thin being returned as waste to the melting house. By these precautions, the blanks when cut out by the next machine will be very nearly all the same weight, which they would scarcely be even if the gauge determined all the plates to the same thickness, because some being more condensed than others, they could not all have the same specific gravity.

Cutting out machine.

PLATE CCI. Figs. 1, 2, and 3.

Fig. 2.

The cutting out machine is explained by Figures 1, 2, and 3, Plate CCI. or at least sufficient is there shewn to describe the whole. A A is a basement of stone to support an iron plate B B. On this, columns C C are erected to sustain the upper part D of the frame. The iron frame of the machine, marked EEF, is fixed down upon the iron plate B: it has a screw *a* fitted through the upper part, which acts upon a slider *b*, supported by a cross bar *c* of the frame: it is cylindrical, but has a leaf or fillet on the front side, to prevent it from turning round. The punch *d* is fixed in the lower end of it, and immediately beneath it is the die or bed *e*, which is adjustible, by screws, to its true position. These parts are very nearly the same as the original cutting out machine; but the manner of actuating it, by the power of a steam engine, instead of hand labour, constitutes the improvement. Above the screw is an axis G, fitted on the top of the screw, with a socket, and the upper end supported by the frame D: above this support, a lever N H is fixed to the axis, to receive the action of cams or wipers fixed on a large horizontal wheel, situated behind the machine. This wheel is shewn in Fig. 2, in which K K is a plan of part of its rim, and L one of its cams.

Plate CCI. Fig. 3.

Fig. 1.

Fig. 1.

In its revolution, it intercepts the roller *g*, at the extremity of the lever H, and by moving it outwards, raises up the screw; but the moment it has passed by, the screw is returned, to cut the plate, by the re-action of a spring, which draws the rod M. This is attached to the arm N, of the lever HN, and therefore draws the roller *g* back the instant the cam has passed by. The rod M draws from a link *m* fitted upon the arm N of the lever, and moveable along it by means of a screw *p*, so as to adjust the power of it at pleasure, by throwing its action at a greater or less distance from the centre of motion G. The motion of the machine can be discontinued at pleasure by means of a catch, Fig. 3; it is marked OP, and moves on the centre P, being constantly pressed upwards by the spring *r*. This catch is situated crosswise beneath the arm N of the lever, and when that lever comes back, the hook O catches and holds it up, so as to prevent its return. When the machine is required to work, the string *s* is pulled, to draw down the catch beneath the plane of the lever's motion. This string, as shewn in Fig. 1, comes down to a treddle R, on the ground, before the machine. The boy who attends the machine, places the plate over the bed *e*, and puts his foot on the treddle when he wishes the machine to work. This relieves the lever N from the catch, and then, every time the cam of the wheel K comes by, it lifts the roller *g*, and raises the punch; but as soon as the cam has passed, the spring makes a stroke, and cuts out a piece of plate, which drops through the bed, and falls out at a spout T. The instant he relieves the treddle, the machine stops, but still the point of the cam strikes the roller *g* every time it comes by. This is avoided when the machine is to be permanently stopped, by the following means: The centre P, of the catch O P, is fixed at the end of a lever, moving on a centre W, Fig. 3, and having a long handle W X, Fig. 1; therefore in pulling this lever, the catch is drawn forwards, and raises the roller *g* quite out of the reach of the cam L. The lower end of the lever, Fig. 1. moves in a notch in the plate B, and thus retains it when it is drawn forwards. Z is a lever fixed on the axis G, and carrying a sweep, or arch, at the extremity of which is a weight or fly *w*, to give impetus to the stroke of the machine; this is checked, when, at the end of its motion, it strikes against a strong vertical wood spring Y, firmly fixed to the framing. The two wheels *x*, which are indented into each other, are to connect the axis G with the socket fitted at the top of the screw *e*, and there admit of adjustment, by turning the screw round a small quantity, with respect to the lever H, to give a greater or less motion to the screw. The Figure shews the clamps which hold the wheels together. The Figures in our Plate, though they explain the construction of the machine, do not exhibit the real appearance of it, because there are twelve of these machines, all mounted on the same frame. They are contained in a very elegant circular room, lighted by a skylight, in the centre. The stone basement A A, Fig. 1, is a circular wall, and the plate B; a ring surmounting it; there are twelve of the columns C supporting a circular iron ring, or frame D; and this has some curious cross framing in it, to support the axis of the wheel K K: this, of course, is common to all the twelve presses, which are situated between each pair of the columns C. An immense horizontal fly wheel is fixed on the axis above the wheel, to regulate the motion. The springs of the rods N, are concealed within twelve columns, which ornament the room, and appear to support the ceiling. The whole is moved by a steam engine of sixteen horse power.

Adjusting the blanks.

The blanks thus cut are next to be adjusted by filing the edges, to bring them to the exact weight; but by the system adopted in the last rolling very little adjustment is requisite, and as soon as this is performed, the edge is milled. This operation, as before mentioned, is not shewn in our mint; but we believe Mr Boulton has improved this process as well as the others; at least some of his coins have milling of a kind very different from any other, and which, we think, could not be done by the machine we have represented in Plate CCI.

Boulton's coining press.

Plate CCII.

Fig. 5.

Fig. 2.

Fig. 1.

The coining press, which is the most beautiful machine of the whole series, comes next to be described, (see Plate CCII,) which is a perspective view of one of the presses complete: AA is a solid stone basement supporting the whole; upon it are erected four columns, rising to the ceiling of the room, and in the centre between these, the press is placed. Its frame marked KK, is screwed down by four bolts shewn at the bottom; *b* is the screw, or rather the spindle of it, the screw itself being concealed within the frame of the press. On the top of the spindle, the fly DB is fixed, and over this a hollow spindle C, like an inverted trumpet, conveying the motion to the press, from machinery contained in the apartment above. The weights BD, at the extremities of the arms of the fly, are limited in the quantity of their motion, by checks affixed to iron beams E and F, extending from one of the columns to the other: These receive the blow of the fly, in case the press should ever make a stroke without a blank being between the dies, and are therefore made exceedingly strong; the columns are of oak. The recoil of the fly, after having struck a coin, is checked by its coming against a piece of wood G, which is fitted into the tube H, fixed to the iron beam E, and having a concealed spring to ease the blow. The upper or moving die is beneath the screw; for this press has no slider like the old one, but the die turns round with it whilst it is making the impression. The screw *b b* is, as the Figure shews, cylindrical at each end, and is fitted in very accurate bearings, adjustible by screws at *a a* above, and at *c c* below; between these it is cut into a worm or screw, and is received in a proper nut, but it depends on this only for its ascent and descent, the fittings at the ends keeping it truly vertical. Fig. 5. explains, by an enlarged view, the connection of the upper die with the screw at this place; *b* is the lower point of the screw; it has a ring *d* fixed on it, having a leaf or tooth projecting downwards, and entering a recess made in a ring *e*, of similar dimensions, which is the upper part of a piece *f*, forming a box, furnished with screws, to hold the upper die; the point of the screw acts upon this piece, and to keep it always in contact therewith, the ring *e* is suspended in a collar *g*; this has two arms, to which bolts *h h* are united by screws; and these bolts (see Fig. 1.) passing up through holes in the solid frame, are united to another collar *k*, which fits on the screw, and rests upon a shoulder formed on it; so that by the adjusting screws on the rods *h*, the collar is always kept tight, and accompanies the screw in its motion. The lower die *l*, Fig. 2. is held in a box I, furnished with adjusting screws, which box is screwed down upon the bottom of the frame of the press, as is seen in Fig. 1. Now a piece of metal being placed on the upper die when the machinery moves the press, and forces the upper die down upon it, the tooth of the ring *d*, Fig. 5. obliges the die to turn with it, so that the coin is struck with a twisting motion, which is supposed to give a better impression; but in the recoil of the screw the die does not at first turn round, or it would inevitably cut away all the raised parts of the impression. This is effected by giving the tooth of the ring *d* considerable latitude in the opening made in the other ring for its reception, and this allows the screw to raise the die quite clear of the coin before it partakes of the twist of the screw.

The steel ring.

PLATE CCII. Fig. 2.

Fig. 3.

Fig. 4.

All the coins in this press are inclosed in a steel ring whilst they are struck, which method we believe was introduced by Mr Lawson, an agent of Mr Boulton, and now an officer in the mint. It is very ingeniously contrived to force out the money from it, which becomes jambed very fast into it by the expansion of the metal. The lower die *l*, as shewn in Fig. 2. is at top reduced to a neck only the size of the money it is to coin, and upon it is fitted the steel ring K, Fig. 3.; this slides freely up and down upon the neck of the die, but has always a tendency to rise up upon it by the action of a triple spring M surrounding the die beneath the ring. It is occasionally depressed by two levers *i i*, Fig. 4. affixed by centre pins to a ring N, which is fixed on the outside of the box I, Fig. 2. holding the lower die *l*. The inside ends of these levers *i i*, act upon the outside of the steel ring K, and the other ends are forked to admit chocks *m*, attached to the lower ends of the rods *h h*, and guided by the anterior edges of the frame, as shewn in Fig. 1.: these, by elevating the tails of the levers *i* whenever the screw rises, depress the opposite ends, and the ring with them. Then, suppose the screw at the highest point of its movement, the ring will be at the bottom, and its upper surface level with the surface of the lower die; now place a blank thereon, and when the screw of the press comes down, the rods descend with it, and the levers permit the springs M, beneath the ring K, to raise it up, and completely inclose the coin before the upper die comes upon it to strike the impression, which being done, and the screw beginning to return with the rods *h*, they elevate the tails of the levers, and thrust the ring down, leaving the coin loose upon the die, which being removed, and another blank placed upon it, the same operation is repeated.

Feeding mechanism.

Figs. 6, 7, 8.

PLATE CCII. Figs. 6, 7, 8.

The blanks are in this machine fed, or placed successively on the lower die by very ingenious mechanism, which is represented on an enlarged scale in Figs. 6, 7, and 8. Its connection with the press can be seen in Fig. 1. where *o n p* is a lever, moveable on a center *n*, and actuated at the upper end by a curved sector *o*, attached to the upper extremity of the screw *b*. This is so curved, that, in the reciprocating motion of the screw, the end of the lever moves alternately to and from the centre of the press. It is guided to move with steadiness, by fitting in a groove *r*. At the lower end it gives motion to a slider P, which carries the blanks singly from a tube, in which they are deposited, and lays them upon the lower die, then returns to fetch others. This slider is fitted in a brass frame or socket R, attached to the frame of the press. Thus, a piece of iron *r*, Fig. 1, is screwed to the check K of the press, with latitude for adjustment. To this the socket R is attached, by means shewn in Fig. 6. The projecting part *s* enters a notch in the upright side of *r*, Fig. 1, and by a centre pin is attached, like a joint, that it can swing round horizontally. The projecting leaf *t*, Fig. 6, embraces the opposite side of *r*, Fig. 1, and having a screw through it, fixes it fast, but admits of adjustment to make the slider carry the blank exactly to the right place. The socket R, Fig. 6, consists of two plates R and S. The projections *t* and *s* being part of the lower one S, and the upper one R is attached to it by screws and a leaf *v*, so that they are parallel to each other, but leave sufficient space between to receive the steel slider P, called the tongs. Q is a tube, into which the blanks are put, ten or a dozen at once, and are taken away one at a time by the tongs: These are shewn detached in Fig. 7. The principal piece is a ruler of steel *w*, to which the other piece *x* is connected by the joint *y*. The end forms a circular opening 1 for the reception of the blank, but will leave it when *x* is opened; 2 is a hook, which, when the tongs advance, enters a socket fixed behind the press; and this being adjustible by screws, ensures its leaving the blank in the exact position. The motion is given to the tongs by a frame of steel 3, Fig. 6. It slides in front of the socket RS, having a pin 4, which enters a fork in the lower end of the lever *o n p*, Fig. 1: It also extends beneath the lower brass plate S, and has three studs, or pins, which rise up from it, and passing through 3 grooves in the bottom plate S, reach the tongs *w*, and give them motion. This is shewn in Fig. 8, which is a plan of the sliding frame 3, 4; and 5, 6, 7 are 3 studs. The latter of these enters an opening *y*, Fig. 7, in the blade *w* of the tongs, where it has a small latitude of motion. The other two studs 5, 6 include the moving half *x* of the tongs between them, near the joint *y*, and act upon surfaces or edges thereof, which are inclined to the direction of motion for the tongs and slider. Its operation is thus: Suppose the tongs drawn back as far as they can be in this situation, the circular opening 1 in the tongs comes exactly beneath the tube Q, Fig. 6, and a blank falls down into the opening. Now, suppose the frame 3, 4 moved forward by the lever *o*, *n*, *p* acting upon the pin 4, its two studs 5, 6, which include the moving blade *x*, tend to shut the tongs up. This gripes upon the edge of the blank, and holds it fast between them whilst it advances, till it comes exactly over the lower die, to which position it is determined, and stopped by the hook 2 entering the socket before mentioned. In returning, the studs 5, 6 will evidently open the tongs before they communicate any motion to them, and will therefore leave the blank exactly where it was placed, and return empty to fetch another. It stops when it comes beneath the tube Q, and another blank falls into the opening 1; but the instant the advancing motion commences, the tongs close up, and hold it tight, as before mentioned. The lever *o*, *n*, *p*, Fig. 1, is made with a joint in it near the lower end, and is furnished with two springs, which act in the same manner as the springs in the back of a knife, to keep it straight, and carry the tongs forward; but if any obstruction arises, the lever bends, without forcing the tongs or slider forwards to break them. The centre *n* of the lever is adjustible to regulate the length of its motion by a sliding centre, which is fitted upon a vertical bar 9 attached to the frame.

Operation.

We have now described all the parts of this very ingenious machine; but it will be proper to say a few words on the manner of their action. The only attention the machine requires, is that of a little boy, who stands in a sunk place before the press, and always keeps the tube Q full of blanks. He has two strings, one of which will, when pulled, put the press in motion by the concealed mechanism in the room above, and by snatching the other string the press stops. Now, suppose the screw and upper die at the highest of their movement; the ball B of the fly, close to the end of the pole G; the lever *o*, *n*, *p*, and tongs P, in a contrary position to that of Fig. 1. viz. holding a blank exactly over the lower die; the ring forced down upon the neck of the die; in this state, by pulling one of the strings, the press starts the screw *b*, and the upper die begins to descend, the tongs open and then withdraw, leaving the blank upon the die. As the motion continues, the small levers *i*, *i* suffer the steel ring K to rise up by its springs M, and inclose the blank. Lastly, the upper die comes down, and strikes the coin with a twisting motion; the recoil and the concealed mechanism immediately causes its return; but the upper die does not partake of the twist of the screw, till the money is relieved. The tongs seize one of the blanks from the tube Q, and then carry it forwards, at the same time the small levers *i, i* depress the steel ring K, and leave the coin loose upon the die; then the end of the tongs, approaching with another blank, throw it forward into a box behind the press. The next stroke instantly succeeds, repeating the operation at the rate of 60 and 70 per minute, and that with very few interruptions for the whole day. The press room contains eight machines, all supported on the same stone base; and the iron beams EF between the columns, serve equally for the presses on each side: The whole has a very grand effect. The eight presses will strike more than 19,000 coins in an hour with only a child to supply each. The grand improvement in these presses consists, 1st, in the precision with which it operates to strike every coin with equal force, which could not be insured by the old press, worked by manual labour. 2d, The rising collar or steel ring in which they are struck, keeps them all of one size, and makes a fair edge, which the old coins never had, being rounded and defaced by the expansion of the metal under the blow. 3d, The twisting motion of the upper die is thought to produce a better surface to the flat parts of the coin, but of this there may be some doubt. 4th, The feeding mechanism is very complete, and allows the machine to work much quicker than in the old press, where the workman being in constant danger of having his fingers caught, was obliged to proceed cautiously, as well as to place the coin true on the die, which was however seldom done perfectly.

The want of feeding apparatus has been long felt as a great defect in the old coining press. In 1731, M. Du Buisson presented to the Royal Academy of Paris, a project for an apparatus to place the blanks upon the dies without depending upon the care of the workmen. It consisted of two sliders, one applied upon the other. The upper one had a hole in it for the reception of the money, the other was only a flat plate, to keep it from falling through. These sliders having taken a blank from a tube where they were deposited, were both advanced together by the movement of the press towards the die, and displacing the piece already struck from the lower die, laid the blank upon it, the lower slider proceeding no farther than the edge of the die. The whole contrivance was imperfect and awkward, but deserves to be recorded as perhaps the first attempt. See *Machines Approuvées par L'Academie*, 1731, vol. v. p. 155.

The feeding mechanism of Mr Boulton's press is also a French invention, as appears from a pamphlet entitled, *Rapport fait a la classe, des Sciences Mathematiques et Physiques, de L'Institut National; sur diverses Inventions de Jean Pierre Droz, relatives a L'Art du Monnoyage.* In this report a coining press, with the feeding apparatus like that which we have described, is minutely detailed, and also several other inventions which display much ingenuity; but they are not so complete as Mr Boulton's contrivances for the same purposes, who, by the application of his steam engine to put them in motion, as well as by several improvements in the making of the dies, has carried the art of coining to a degree of perfection hitherto unknown. (J. F.)

COIX, a genus of plants of the class Monœcia, and order Triandria. See BOTANY, p. 320.

COKE, SIR EDWARD, Lord Chief Justice of England, and one of the most distinguished lawyers whom his country has produced, was born of a good family, at his father's seat at Mileham in the county of Norfolk, in the year 1550.

A liberal course of education, according to the forms of discipline established at that period, contributed to bring to maturity those great talents, which were afterwards exerted, with so much benefit to his country, in the affairs of public life. At the age of ten, he was placed at the free-school at Norwich, whence he repaired to Trinity College, Cambridge, where he remained about four years. He then removed to Clifford's Inn, and, in the following year, was entered a student of the Inner Temple.

While in this situation, he already began to exhibit extraordinary proofs of his proficiency in the study of legal science, and of those acute powers of mind, for which, at a more mature age, he became so highly distinguished. These proofs of application and ability did not pass without observation and reward; for at six years standing, he was called to the bar; which was reckoned unusually early in those strict times. The first cause in which he appeared, in the court of Queen's Bench, was a remarkable action upon the statute *de scandalis magnatum*, in Trinity term 1578, which seems to have excited considerable interest, and of which he himself has given a judicious report. (See Rep. P. iv. fol. 12. b. 14. b.) About the same period, he was appointed Reader of Lyon's Inn; which situation he continued to fill during three years; and, by means of his lectures, which were much resorted to, he increased his reputation and his practice.

From this period he rose very rapidly in his profession; was chosen recorder of the cities of Coventry and Norwich; appeared in all the great causes which were tried in Westminster Hall; and was elected knight of the shire by the freeholders of Norfolk. He filled, successively, the offices of solicitor and attorney-general to the queen; and in the parliament held in the 35th year of Elizabeth, he had the honour of being chosen speaker. Towards the latter end of the reign of that princess, such was the degree of eminence to which he had attained, that he was constantly consulted by her majesty's ministers upon every matter of difficulty; and such was the estimation in which his talents and integrity were generally held, that, with his sanction, many measures, which might otherwise have appeared unusual and arbitrary, were rendered agreeable to the feelings of the people.

As attorney-general, he took a very active part in the conduct of the various and important state trials, which occurred in that and the succeeding reign. In the proceedings against the Earl of Essex, Sir Walter Raleigh, and the gun-powder traitors, he displayed uncommon vigilance, sagacity, legal knowledge, and oratorical powers; although in some of these, particularly during the trial of the unfortunate Raleigh, the lustre of his great talents was, in some measure, obscured by his intemperate behaviour and insulting language towards the accused, for which it were difficult to find an apology. In conducting the prosecutions instituted against the gun-powder conspirators, he exhibited an extraordinary degree of industry and acuteness; and with great ingenuity developed the origin, progress, and objects of that singular and nearly successful plot. His address to the jury in the trial of Garnet, one of the conspirators, was much admired at the time, and is still by many esteemed the masterpiece of this celebrated lawyer.

Although he enjoyed the highest reputation for learning and ability, Mr Coke does not appear to have courted admission to the presence of his sovereign, or to have solicited those honours and dignities to which his talents might have entitled him to aspire, with that avidity and impatience which are so usual among men who enter upon the career of public life. Upon the 22d of May 1603, however, when King James entertained the principal persons of the kingdom at Greenwich, on account of his quiet accession to the throne of England; Mr Coke, together with the Mayor and Recorder of London, received the honour of knighthood.

But higher dignities now flowed fast upon him. In consequence of his extraordinary exertions during the prosecutions above mentioned, he was called to the degree of a serjeant, on the 20th of June 1606; and on the last day of the same month, he was advanced to the situation of Chief Justice of the Common Pleas. This office Sir Edward filled, during several years, with ability and uprightness, and seemed desirous of retaining it; but, in consequence, it is believed, of some court intrigues, he was removed to the situation of Chief Justice of the King's Bench. Although, in this capacity, he evinced no great partiality for the unlimited prerogative of the crown; yet such was the favour he enjoyed from the king, and the expectations which were formed of the great services he was capable of rendering to the state, that, in the month of November 1613, he was sworn of his Majesty's Privy Council.

At this period, Bacon, the celebrated philosopher, was engaged in the pursuit of the same public honours, which the talents of Coke had already enabled him to attain. But the conduct of these two great rivals on the *arena* of public life was widely different. The upright mind of Coke disdained to employ any of those petty artifices, or to engage in any of those political intrigues, which are but too often resorted to as the most effectual means of advancement; and, trusting to his learning and abilities alone for distinction, it was his boast to have obtained the various offices, which he successively filled, "without either *begging* or *bribing*." Bacon, on the contrary, less impressed with a sense of the true dignity of human nature, than his scientific attainments might have led us to presume, did not hesitate to stoop to any means, however base and unjustifiable, by which he might raise himself to that station, which his genius and learning, had he relied solely upon them, would probably have procured for him in a more honourable manner. The avowed rival of Coke, he neglected no opportunity that occurred of attempting to diminish the respect which was universally paid to the talents and integrity of that great man, and to supplant him in the favour of those, in whom were the fountains of honour and reward. It affords an humiliating instance of the weakness of human nature, to behold genius and talents, which were calculated to grasp and embody the most important truths of science, thus prostituted to the meanest and most selfish purposes of personal elevation,—to see the mind of a Bacon exhausting and misapplying its energies on the paltry arts of political rivalry and court intrigue.

The pliant servility of Bacon prevailed over the ingenuous and manly virtue of Coke. Having succeeded, at length, in gaining entirely the ear of the king, he did not find much difficulty in procuring an opportunity of humbling his antagonist. In the course of the prosecutions which were carried on against the Earl and Countess of Somerset, and the other persons who were accessaries to the murder of Sir Thomas Overbury, the conduct of the Chief Justice, which appears to have been able, upright, and honourable, was misrepresented to the king and the people; the part which he took in the crown's cause of *Commendams*,* and in the discussion regarding the privileges of the Court of Chancery; and, above all, his unbending demeanour towards the favourite, Villiers, contributed gradually to deprive him of the royal favour; and the ultimate consequence was, that Sir Edward was suspended from the execution of his office, on the 30th of June 1616.

The talents of this able man, however, were too serviceable to the state to be long dispensed with; and accordingly we find that, a short while thereafter, he was restored, in some measure, to the favour of the king, and re-instated in his place as a privy-counsellor. It would appear, too, that the animosity of Bacon against him had at length relaxed; probably because he considered the friendship of Sir Edward as a necessary means of furthering his own ambitious views of aggrandisement.

From this period he was engaged in many important affairs of state, and the greatest deference was paid to his opinion upon every measure of policy which the crown proposed to adopt. In the year 1620, the king's affairs appeared to be in such a state of embarrassment, as absolutely required the calling of a parliament; at least, this measure was strongly advised by the Lord Chancellor Bacon, after consulting with Sir Edward Coke. The conduct of Sir Edward, however, proved very different from what the court and the favourite, Buckingham, had expected; and, instead of becoming a mere tool in the hands of the ministry, he shewed himself, upon every occasion, to be a steady and patriotic friend to the liberties of his country. In consequence of the freedom and boldness with which he opposed the illegal pretensions of the crown in Parliament; he was, on the 27th December 1621, committed to the Tower; while, at the same time, his chambers in the Temple were broken open, and his papers taken out and delivered to certain persons to be examined. On the 6th of January, 1622, Sir Edward was charged before the council with having concealed some true examinations, in the great cause of the Earl of Somerset, and substituting false ones in their place. This charge, however, was not followed up by any proceedings against him, and does not, indeed, appear to have had any real foundation; for he was soon afterwards released from confinement; but the king thought proper, for the second time, to strike him off the list of privy counsellors. Towards the close of the year 1623, we find his name joined with several others, in a commission issued by the king relative to the affairs of Ireland; but this might be considered rather as a species of honourable banishment, than as a mark of the royal favour and confidence; and it does not appear that he ever left the kingdom.

During the remainder of King James's reign, Sir Edward continued to adhere firmly to his principles and opinions; nor is there any appearance of his having again attempted a reconciliation with the court. In the parliament which was held in the year 1628, he was chosen knight of the shire for the county of Bucks, and

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* The question was put to the judges: "*Whether, in a case where the king believed his prerogative or interest concerned, and requires the judges to attend him for their advice; whether, in such a case, they ought not to stay proceedings till his Majesty has consulted them?*"

All the judges submitted to the affirmative side of the question, excepting Coke, chief justice of the King's Bench, who said, "*That when the case happened, he would do his duty.*"

Coke.

greatly distinguished himself by the strenuous support which he gave to all questions favourable to the liberty of the subject, and the privileges of the commons. He took a most active part in all the important discussions which occupied the attention of this parliament, and had the principal share in proposing and framing the famous *Petition of Rights*. On the 5th of June of the same year, he vindicated the right of the House of Commons to proceed against any subject, how exalted soever he might be, and expressly denounced the Duke of Buckingham as the "grievance of grievances," and the great cause of all the calamities of the country.

But the active and useful life of this distinguished statesman was now drawing towards a conclusion. After the dissolution of this parliament, on the 28th of March 1628-9, he retired to his house at Stoke-Pogey's in Buckinghamshire, where he spent the remainder of his days in a state of seclusion from public life. He died there, on the 3d of September 1634, in the eighty-sixth year of his age.

The person of Sir Edward Coke was well proportioned, his features regular, his countenance grave, and his manner dignified. In his dress he was always neat, without foppery or ostentation; and it was a saying of his, "that the cleanness of a man's clothes ought to put him in mind of keeping all clean within." His mind was active, vigorous, and penetrating; his memory retentive, and his judgment solid. Strength and conciseness formed the general characteristics of his legal pleadings; but in his writings and set speeches he adopted rather a diffuse style; which may have proceeded partly from the redundancy of his learning, and partly from the quaint manner of the times in which he lived. He appears to have possessed all the qualities which are requisite to form a great lawyer; and no man ever studied the laws and customs of his country with greater zeal, assiduity, and success, or displayed more acuteness in tracing the principles upon which they are founded. As a judge, he enjoyed the highest character for talents, learning, and integrity; and there are few men whose lives have been more entirely and sincerely devoted to the service of their country, and to the maintenance of its constitution. As a servant of the crown, he was zealous and faithful; and while he supported the just prerogative of the executive, he did not hesitate to oppose any attempts to stretch it beyond the legal and constitutional bounds.

During the course of his public life, he experienced many changes of fortune; but in every situation he preserved the same composure of mind and consistency of conduct: thus verifying the prediction of King James, who is reported to have said of him, "that which ever way he was thrown, he would fall upon his feet." When removed from his office of chief-justice, there is reason to believe, that he might have retained his situation had he shewn sufficient compliance with the wishes of the court; but when such an overture was made to him, his answer was, "that as a judge ought not to *take*, neither ought he to *give* a bribe," nobly preferring the loss of office and emolument to the prostitution of his talents. He is said, indeed, to have valued himself chiefly upon having obtained all his steps of preferment, "without employing either prayers or pence." Towards the latter part of his life, although connected by various ties with the persons in power, he devoted himself zealously and steadily to the service of the people, and exerted his talents, upon every occasion, in the defence of their rights and liberties, against the arbitrary encroachments of the crown.

Sir Edward was twice married. His first wife was Bridget, daughter and co-heiress of John Paxton, Esq. with whom he acquired a considerable fortune, and by whom he had seven sons and three daughters. By his second wife, Elizabeth, daughter to Thomas, Earl of Exeter, he had two daughters.

Colbert.

Although he was constantly engaged in the active business of life, he yet found leisure to compile several laborious and highly valuable works, illustrative of the laws and constitution of his country. These are,

1. His Reports of Cases and Matters in Law; in thirteen parts: Of which eleven were published by himself, the other two having appeared after his death. These reports are so highly esteemed, that they are generally cited without the author's name.

2. A "Book of Entries, containing perfect and approved precedents of Counts, Declarations," &c. Fol. 1614.

3. His "Institutes," in four parts; the first of which contains a comment upon Littleton's treatise of tenures; the second, a comment upon *magna charta*, and several other ancient acts of parliament; the third, a treatise of the pleas of the crown; and the fourth, an account of the several courts of the kingdom.

4. "A Treatise of Bail and Mainprize." London, 1637, 4to.

5. "Reading on the Stat. of Fines." London, 1662, 4to.

6. "Complete Copyholder." London, 1640, 4to.

See *Biographia Britannica*, vol. ii. (*z*)

COLBERT, John Baptiste, Marquis Sagnelai, an eminent statesman of France, whose family was originally from Scotland, was born at Rheims, in 1619. He displayed, at a very early age, an uncommon partiality for commercial and financial speculations. He read with avidity all the ablest works on these favourite subjects, and made a tour through the provinces of France, with a view of acquiring an accurate knowledge of the state of its manufactures and its trade. His distinguished talents as a financier procured him the favour of the Cardinal Mazarine, who honoured him with his unlimited confidence, entrusted to his management the most important concerns, and during his last illness, not only appointed him one of the executors to his will, but recommended him to his sovereign, as a person entitled, by his worth and qualifications, to the highest offices in the state. In compliance with the recommendation of his distinguished minister, Louis XIV. appointed Colbert intendant of the finances. His exertions, in this important situation, were highly judicious and beneficial. By abolishing those useless places, which had been created, not for public utility, but to favour individuals, by restoring order in the receipts and payments of the exchequer, and by a rigid regard to economy, he materially improved the treasury, while he diminished the load of taxes which his predecessors had imposed upon the people. He effected another equally important, and more difficult reformation, by establishing a court of justice to examine and decide on all financial concerns. By means of this court he recovered many alienations of the revenue, and suppressed many unjustly acquired annuities, the original of which he caused to be repaid. Nor was he was less active as superintendant of the public buildings, to which situation he was appointed in 1664. Ambitious to give to the palaces and buildings of Paris a splendour suitable to the grandeur of the French monarchy, he invited from all the countries of Europe architects, sculptors, and other artists of distinguished eminence, whom he employed on the most liberal terms, in their embellishment. His principal attention, however, was occupied by the grander project of promoting the commercial importance of his country. As a preparatory step to the completion of his magnificent designs, he increased the royal navy far beyond its former strength; and having thus secured protection for future adventurers in trade, he determined, notwithstanding all the misfortunes and failures of his predecessors, to revive the French East India Company. For this purpose it was necessary, not only to acquire an accurate and comprehensive knowledge of every thing requisite to ensure the success of his project, but to give a new impulse to the public mind, discouraged by so many disappointments. Having procured, therefore, the necessary information from those mercantile people who were most conversant with East India affairs, he employed the pens of the most able academicians to explain and recommend his views, and thus to engage the hopes and energies of the nation in their promotion. By these exertions he completely succeeded, and had the honour of accomplishing an object which had baffled the most strenuous efforts, and disappointed the most sanguine hopes of some of the ablest politicians of France. The establishment of the East India Company, was followed by that of the West India and African Companies, from which many important advantages accrued to his country. While thus occupied in the extension of its commerce, he did not overlook its internal manufactures: and scarcely a year of his ministry passed without the introduction of some new manufacture, or of some improvement in those previously established, to employ the industry of his countrymen, and to ameliorate their condition. Perhaps nothing contributed more essentially to these important ends, than the grand canal of Languedoc, by which he united the two seas that bound the opposite coasts of France. This magnificent undertaking, which was completed in fourteen years, will entitle Colbert to the perpetual gratitude of the French nation. By his zealous encouragement of literature and the arts, he has established as indisputable a claim to the gratitude and admiration of the learned in every country, and to the latest posterity. He established the French academy of painting; the institution of the academy of science was owing in a great measure to his patronage and his exertions; and the academy of inscriptions took its rise from an assembly of some literati in his house for the purpose of furnishing designs for the king's medals. On the theological student he has conferred an important favour, by the collection of those manuscripts of the Greek Testament, which are known by the name of *Codices Colbertini*, and are now in the royal library of Paris. Five of these MSS. containing the four gospels, of which two are referred to the 11th century, were collated by Simon, and their readings noted in the margin of Curcellæus's edition of the Greek Testament. Mills, in his edition of the Greek Testament, has given a variety of readings from seven other Colbert MSS; made very superficially by Larroque, and communicated by Alix. One of these, divided by Mill into three separate MSS. contains the whole New Testament, except the book of Revelation, and was supposed, in Mill's time, to be 600 years old. Griesbach, in his Symbolæ, defends this MS. against the suspicion of its having been altered from the Latin, assures us that its readings harmonize with those of Origen, refers it to the eleventh or twelfth century, and esteems it a MS. of great value. Wetstein collated, in 1715, twelve other *Codices Colbertini*, which are merely lectionaria of the four gospels.

Colbert, after a life of extensive usefulness, and after having filled many important situations in the state, died in September 1683, in the 65th year of his age, leaving behind him few equals for uncorrupted integrity, grand views, and extensive knowledge as a politician, with a zeal and perseverance before which the most formidable obstacles were compelled to yield. See Voltaire's *Age of Louis XIV. Histoire de France. Univ. Hist. Nouvelle Dictionaire Historique.* For an account of the *Codices Colbertini*, the reader may consult, *Bibliotheca Colbertina*, Parisiis, 1728; Montfaucon's *Bibliotheearum*, tom. ii.; the second volume of the *Catalogue MSS. Bibliothecæ Regiæ*; and Michaelis's *Introduction to the New Testament* by Marsh, vol ii. iii. (*k*)

COLCHESTER, a town of England, in the county of Essex, is situated on the banks of the navigable river Colne, on the top and northern side of a gentle eminence. The river, which is crossed by three bridges, flows on the north and east sides of the town. Although the greatest care was taken to preserve the ancient walls which surrounded the town, and consisted of stone and Roman brick, yet they are now in a great measure destroyed. When the walls were perfect, they enclosed an area of 108 acres, and the town was entered by four principal gates and three posterns. Several bastions, and an old Roman fort, contributed to the strength of the town, and deep ditches were cut where the defences were weakest. The part of the town with the out walls is extremely irregular. The principal street, which stretches due east and west, is adorned with several elegant houses and shops, but is broken by the intervention of the old market-house and other small buildings.

Upon an eminence, called the Bailey, in the centre of the town, to the north of the high street, stand the venerable ruins of the castle, built by Edward, son of Alfred the Great. The outer walls of the keep, which are remarkably thick and solid, are nearly perfect, and, like the rest of the building, seem to be constructed of stone, flint, and brick. The principal public buildings in Colchester, are the Baize-hall, where the goodness of the baize manufacture is tried by a corporation; the Guild-hall, called also the Moot-hall, built by Eudo; the town gaol; the work-house; the theatre; the free grammar school; the barracks, for cavalry and infantry; the public churches; the ruins of St John's Abbey, and St Botolph's Priory; and several charity-schools, and almshouses.

St John's Abbey, which was a very magnificent building, was founded in 1097 by Eudo Dapifer; but very little more than the entrance gateway, built with hewn stone and flint, now remains. The construction of the abbey church was singular, having a central tower with circular angles terminated by small spires of a conical form. The priory church, which contains some interesting specimens of interlacing arches and brick ornaments, was almost demolished during the civil wars. The original length of the building within the walls was 108 feet, and its breadth, including the nave and aisles, 44 feet. St Mary Magdalen's hospital was founded for persons afflicted with leprosy. It consists of a few old buildings to the north of St Magdalen's church. The principal churches are St James's, founded about the reign of Edward II. and consisting of a body chancel and side aisles, with a square tower at the west end; All Saints church, built before 1356, and having its tower chiefly of flint, with some stone work at the angles; St Nicholas's church, which is partly in ruins, the tower having fallen in through the body and chancel some years ago; Trinity church, which contains a monument to the famous Dr Gilbert, the founder of the science of magnetism; St Martin's, erected about the year 1327, which is now in ruins, and has its tower partly composed of Roman brick; St Peter's, founded previous to the conquest; and St Mary's, which stands in an elevated situation, near the south-west corner of the town, and which had its main tower raised 12 feet, was repaired in 1729.

The river Colne is navigable for large vessels within three miles of the town, and up to the Hythe it is capable of receiving brigs and small vessels which come close to the houses, where there is an extensive quay and custom house. The principal articles of manufacture are, baize, say, serges, and some other woollen articles, which give employment to the inhabitants in the town and its vicinity. About 100 looms are employed in silk goods, and a considerable trade is carried on by means of the oyster fishing, the Colchester oysters being in great demand.

The following is the population of this town in 1811:

Number of inhabited houses, ...	2111
Number of families that occupy them, . . .	3093
Uninhabited houses, ...	57
Families chiefly employed in agriculture, . .	480
Families chiefly employed in trade, &c. . .	1152
Males, ...	5400
Females, ...	7144
Total population, ...	12544

For a full account of the history and antiquities of Colchester, see Morant's *History of Essex*, vol. I.; *Philosophical Transactions*, Aug. 1699; *The History and description of Colchester*, 1803; and Brayley and Britton's *Beauties of England and Wales*, vol. v. p. 286. (*o*)

COLCHICUM, a genus of plants of the class Hexandria, and order Monogynia. See BOTANY.

COLCHIS, or COLCHOS, now *Mingrelia*, was an ancient kingdom of Asia, bounded on the east by Iberia, on the south by Armenia and Pontus, on the west by the Euxine Sea, and on the north by Mount Caucasus. Its principal rivers, all of which disembogue themselves into the Euxine, are the Ophis, the Cissa, the Phasis, the Cyaneus, the Absarus, the Charistus, the Hypus, and the Corax. Its cities, which deserve notice, were Aca, the metropolis of the dynasty; Pitynus, now Pitchinda; Dioscurias; and Cyta, formerly Cuta, the birth-place of Medea. The whole region, though remarkable for the number of its poisonous herbs, which perhaps gave to its honey that bitter flavour which it is said to have possessed, was exceedingly fruitful in every necessary that could administer to the comfort of its inhabitants; and as it abounded in flax, hemp, wax, pitch, and timber, it was not only well adapted, by means of the rivers which intersected it, for internal traffic, but likewise to carry on an extensive foreign trade by navigating the Euxine. Hence, along the shores of this sea, the Colchians established many settlements, which served as marts for their various articles of commerce; and to which they exported, not only the raw productions of the country, but also the goods which they manufactured, especially linens, which they carried to a great degree of perfection. They were no less famous for the exquisite figures of flowers and animals with which they variegated their cloths; and for the beauty and durability of their colours, which no washing or length of time could efface. We may add, that the mines of gold, which enriched this territory, are said to have given occasion to the voyage of the Argonauts, which we formerly described, and which became the subject of some of the most pathetic strains which ever flowed from the romantic Muses of Greece and Rome.

The most probable conjecture concerning the first inhabitants of Colchis, is, that they were a branch of the Cuthites, who, in the most remote antiquity, emigrated from their native country in Arabia, and settled there. Hence, though they were not the real descendants of Mizraim, who peopled Egypt, as has been generally thought, they were undoubtedly a kindred race, and bore a striking resemblance to them. Herodotus, not to mention Diodorus, Apollonius, Strabo, &c. who appear to have copied him, asserts that the Colchians resembled the Egyptians in their form and features; in their woolly hair and dark complexion; in their language, laws, and manners; in their manufactures and commerce. Nor can we omit, that this region, before its name degenerated into Colchis, was denominated Cuteis, or Cutais; and one of its chief cities, Cuta, or Cutaia; appellations, in all probability, derived from Cush, the founder of the Cuthites. From Herodotus we likewise learn, that long after this emigration, Sesostris, king of Egypt, when warring with the Scythians, left a part of his army in Colchis to defend the passes, who settled in that region; and that colonies of the Ampreutæ, the Lazi, the Heniochi, the Istri, the Marsi, the Moschi, and the Manralæ, from the last of whom some deduce the name of Mingrelia, at different periods, increased the original inhabitants of the country.

That Colchis was at first governed by independent princes, must be admitted, but their names and exploits have not descended to our times. Œetes swayed the sceptre, when the Argonauts landed upon his shores, and deprived him of the golden fleece, and the beautiful Medea. At his death, according to Strabo, the kingdom was divided into several petty dynasties; but we find it again united in the time of Xenophon, who informs us, that when he penetrated, under Cyrus, into Asia, a descendant of Œetes, who bore the same name, reigned there. Mithridates the Great, in his first career of victory, overran the country; but when he was forced to yield to the superior destiny of Rome, the Colchians again asserted their freedom. Peace being obtained from Sylla, Mithridates led his forces to take vengeance on the Colchians, who, afraid of his arms, offered to receive his son, who bore the name of his father, as their king, provided that the independence of the crown should be acknowledged. The king of Pontus seemingly agreed to this request, and the Colchians laid down their arms; but the haughty soul of the invader cherished in secret a deep-rooted resentment, not only against the state who made the proposal, but against the son, who seemed to be preferred to himself. When the young prince was about to take possession of his kingdom, his father, yielding to the dictates of jealousy and ambition, loaded him with fetters of gold, and at last put him to death. The spirit of the Colchians, roused at this unworthy treatment, set at defiance the power of Mithridates, which he led to subdue them; but his army, which he conducted through the hostile territory of the Achæans, a people situated on the eastern shore of the Euxine, was almost annihilated by the ambushes of the inhabitants and the rigours of the climate; and the Colchians were delivered from his arms. Olthaces, who afterwards mounted the throne of Colchis, entered, however, into an alliance with Mithridates, in a subsequent war with the Romans; but his forces yielded to the legions of Pompey, who took him prisoner, and led him in triumph. As the reward of services rendered to Pompey in that war, the Roman general raised one Aristarchus to the throne of Colchis. His reign, however, seems to have been but short; for Pharnaces II. son of Mithridates, soon after subdued the kingdom of Colchis, whilst Cæsar was wasting his time in the embraces of Cleopatra; but when that leader again returned to the field, the conqueror of Colchis lost the fruits of his victory. Our attention is not again called to the Colchians, till the reign of Trajan, to whom they willingly submitted. It is probable, that the king which they had at this time, was allowed to reign in subjection to the Romans; but the country was soon deprived of this shadow of royalty, and without being even formed into a province by any of the emperors, it fell under the jurisdiction of the Prætors of Bithynia and Pontus. We shall only add, that Colchis shared in the fortunes of the eastern empire, when it was overturned by its barbarous invaders, and now forms a province of Asiatic Turkey. (N)

COLD.

Definition.

COLD, is a peculiar sensation excited in animals, when substances at an inferior temperature are applied to their organs of feeling. It is also used to denote a certain principle or power residing in bodies, by the operation of which the sensation is produced. It is still doubtful, whether this principle ought to be regarded as a distinct condition of matter, or as a mere modification of caloric; though we are disposed to consider it in the latter point of view.

The means, with which we are acquainted, of reducing the temperature of bodies, are much more limited in their effects, than those of increasing it. But many important facts connected with the production of cold have already been discovered; and though we can scarcely expect ever to acquire the same extensive command over the lower, as we already possess over the higher temperatures, we have reason to hope, that since we know the circumstances upon which refrigeration depends, processes of cooling may yet be discovered still more effectual than any that have hitherto been employed.

The various methods of producing cold, which are at present known, may all be referred to Rarefaction, Evaporation, and Liquefaction, induced by chemical action. We shall consider, in order, each of these methods of reducing the temperature of bodies.

Production of cold by rarefaction.

If an aërial fluid be suddenly enlarged in volume, by the removal of any mechanical pressure to which it may have been subjected, its temperature is perceptibly diminished. Thus, a thermometer exposed to the stream of air which issues from an air-gun, has its temperature reduced 5 or 6 degrees; and a similar effect is produced when it is inclosed in the receiver of an air pump, during the process of exhaustion. The diminution of temperature by rarefaction, is well exemplified by the celebrated fountain of Hiero, at the mines of Chemnitz in Hungary, where the air in a large receiver is compressed by a column of water, equal to the weight of about 8 atmospheres. On turning a stop-cock, the air suddenly makes its escape, and during its expansion, deposits the watery vapour which it held in solution, in the form of snow, or covers the inside of the tube through which it rushes, with slender spiculæ of ice. In most cases, however, this method of producing cold is very limited, and scarcely capable of being applied to practical purposes.

Production of cold by evaporation.

Evaporation is of more extensive influence in reducing the temperature of bodies, than rarefaction. Every person must have felt, that when the hand has been dipt in water and then exposed to a current of air, the parts which had been moistened soon became much colder than the parts which had been allowed to remain dry, though the cooling medium is the same. Dr Cullen appears to have been the first who ascribed the difference of effect to the evaporation of the fluid. He observed, that a thermometer, the bulb of which had been dipt in a fluid, and then exposed to a current of air, always indicated, so long as it remained moistened, a lower temperature than the air itself; and that the reduction of temperature was greatest when the thermometer had been dipt in the most volatile fluids. If the bulb of the instrument be surrounded with a piece of linen well moistened with ether, and afterwards exposed to a free current of air, the temperature is reduced from 50° to near zero. The effect with alcohol is considerably less, and with water it is limited to four or five degrees. Water may, in this manner, be frozen, by pouring a small quantity of it into a slender tube which is surrounded with linen moistened in ether, and then swinging the tube rapidly round the head by means of a string attached to it.

Freezing of water by the evaporation of ether in the open air.

When water is made to ooze slowly through porous unglazed earthen vessels, it presents a very extensive surface to the atmosphere, and as it suffers a proportional degree of evaporation, its temperature is kept considerably below that of the air. If one of these porous vessels be allowed to imbibe water for some time, it retains, when the water is poured out of it, a considerable quantity of moisture; and as it now presents both an internal and an external surface to the air, the evaporation is greatly increased. The absorption of caloric for the conversion of the water into vapour is increased in an equal degree, and consequently a greater reduction of temperature is obtained. Accordingly, liquors are very conveniently cooled, by placing the bottles which contain them, in these unglazed earthen vessels, previously well moistened with water. Wet cloths wrapped round bottles produce the same effect. In India, where the conversion of water into ice is the sole employment of many individuals, the water to be frozen is exposed during the night in flat unglazed earthen vessels, which are placed upon the worst conductors that can be procured, such as sugar canes, dried stems of maize, &c. The dryness of the air causes a very considerable evaporation, and the consequent reduction of temperature is such, that a thin film of ice is formed towards the morning, though the temperature of the air may have been all the time above the freezing point. The quantity of ice obtained is greater when the weather is warm and dry, than when it is moist, though in the latter case the temperature of the air may have been actually lower.

Method of procuring ice in India.

As liquids assume the state of vapour, at a very reduced temperature, when the pressure of the atmosphere is removed from their surface, it might be expected, that a more rapid as well as a greater production of cold would be obtained by inclosing them in the receiver of an air-pump, and then exhausting the air. Accordingly, if a small tube, about a quarter of an inch in diameter, and four or five inches long, be nearly filled with water, and

Freezing of water by the evaporation of ether under an exhausted receiver.

then placed in a beer glass containing about a cubic inch of ether; if in this state, the whole be included in the receiver of an air-pump, and the air be exhausted slowly and gently, the ether will pass into a violent ebullition, and soon be converted into vapour. But in order to undergo that change of condition, the ether must derive the necessary supply of caloric, either from itself, or the contiguous bodies. This abstraction of caloric soon reduces the temperature of the ether, and that of the bodies in contact with it; and at length a degree of cold is produced sufficient to freeze the water inclosed in the tube. It is necessary, however, to continue the process of exhaustion during the whole of the experiment, otherwise the vapour of the ether would soon act by its elasticity on the surface of the liquid part of it, and produce the same mechanical effect as the atmosphere.

Freezing of water by its own evaporation under an exhausted receiver.

Mr Leslie has suggested a beautiful variety of this experiment. It occurred to him, that, by a sufficient degree of exhaustion, water itself might be converted into vapour at the ordinary temperature of the atmosphere; and that the quantity of caloric necessary for that purpose being abstracted from the water, might reduce its temperature so much as to cause it to freeze. In order to supersede the necessity of removing the vapour by continued exhaustion, he inclosed a quantity of highly concentrated sulphuric acid under the same receiver with the water subjected to experiment, in a separate vessel. The acid, by its strong attraction for humidity, absorbed the vapour of the water as fast as it was disengaged, and thus left the vacuum as complete as before, while the water, by being gradually deprived of its caloric, was at last reduced to the freezing point, and passed into the state of ice. We shall state, very briefly, the circumstances to be attended to in performing this very interesting experiment. The air-pump must possess an exhausting power, capable of bringing the gage within at least half an inch of the barometrical column; the sulphuric acid should be highly concentrated, and should present as large a surface as the receiver will allow, for absorbing the vapour as rapidly as possible. The cup for holding the water, should be made of unglazed earthen ware, very flat, and placed at such a distance from the sulphuric acid, as not to be affected in any great degree by the increase of temperature which it suffers from absorbing the vapour. And lastly, the receiver should not be larger than is barely sufficient for containing the apparatus for the experiment.

Arrangement of the apparatus.

The vessels for containing the water and the sulphuric acid, are disposed in the following manner: The cup which contains the acid is placed on the plate of the air-pump, and a flat vessel of the shape of a beer-glass is then placed in it, to support the porous cup which contains the water, and keep it at a sufficient distance from the acid. By this arrangement, the cup containing the water is protected from any radiation that might take place from the sulphuric acid, while the glass, being a bad conductor, suffers very little heat to be conveyed by transmission. Instead of sulphuric acid, any other substance that has a strong attraction for humidity may be employed, as dry potash, muriate of lime, &c. though sulphuric acid, when it is highly concentrated, appears to answer the purpose best. We have indeed, determined by experiment, that when equal weights of sulphuric acid, and various deliquescent salts, are placed under a receiver, and the air exhausted, the sulphuric acid abstracts moisture from all of them which we have tried.

If the air-pump be good, and the sulphuric acid sufficiently concentrated, the congelation of the water generally takes place in two minutes, even when the temperature of the room is 50° or 60° of Fahrenheit's scale. We have had an opportunity of performing the experiment with a very powerful air-pump, constructed by Miller and Adie, which brings the gage to within $\frac{1}{10}$ of an inch of the barometrical column, and have sometimes succeeded in *a minute and a half* from the commencement of the exhaustion, though the temperature of the water was then 60°. When the exhaustion is nearly completed, the water is thrown into a state of violent ebullition, and occasionally large bubbles are arrested before they have time to burst, and suddenly converted into thin hemispheres of ice. At other times, if the exhaustion be less perfect, and carried on without exposing the water to much agitation, the temperature is frequently reduced 10° below the freezing point without congelation taking place; but upon giving a sudden blow to the air-pump, and thus communicating a tremulous motion to the apparatus, the water is instantly frozen, while the temperature starts up to 32°.

We may determine by an approximated calculation, how much of the water must be evaporated, to reduce it from some given temperature to the freezing point. Thus let the temperature of the water at the commencement of the experiment be 50°: since water, in its transition to vapour, absorbs as much caloric, as in a sensible state would raise its temperature about 900°, in order that it may be reduced 18°, or from 50° to 32°, a quantity of the whole must be evaporated equal to $\frac{18}{900}$, or $\frac{1}{50}$.

The same experiment performed by means of the vacuum procured by steam.

We have succeeded in performing the experiment of Mr Leslie, with the partial vacuum procured by steam. The boiler we employed for the purpose was pretty large, and had an iron lid soldered to it, in the middle of which was a stop-cock, having an internal screw adapted to the external screw of another stop-cock. The latter was affixed to the under side of a brass plate, which was intended to support the receiver and the freezing apparatus. The boiler was placed on a brisk fire, with a little water in it, and the stop-cock was left open, to allow the air to escape. After the water had boiled a sufficient time to expel the air, the stop-cock was turned, and at the same instant the boiler was removed from the fire, and plunged into a vessel of cold water. When the steam was sufficiently condensed, the brass plate with its apparatus was screwed to the stop-cock of the boiler, a collar of leather being interposed between the screws, to make the junction air tight. The stop-cock of the boiler was then turned, and a communication being thus opened between the receiver and the boiler, the air rushed by its elasticity from the latter to the former, and produced a partial vacuum in the receiver. The stop-cock connected with the plate was then turned, and unscrewed from the stop-cock of the boiler. The process of expelling the air from the boiler by steam was repeated, and after the vapour was condensed, a communication was again opened as before between the receiver and the exhausted boiler. This was repeated, until the exhaustion of the air in the receiver was sufficiently great for the success of the experiment. When the receiver was small, three or four times were sufficient.

We are disposed to think, that this experiment might also be repeated very conveniently, by means of a Torricellian vacuum obtained by water.

Freezing of mercury by the evaporation of ice under an exhausted receiver.

As it was well known that ice suffered a gradual diminution by evaporation, even when the temperature was considerably below the freezing point, Mr Leslie concluded, that this evaporation would go on still more rapidly *in vacuo*, and that a great reduction of temperature would be obtained, by placing a quantity of ice under a receiver, in circumstances similar to those we have already described, and then exhausting the air. He therefore attempted to freeze mercury, by incrusting the bulb of a thermometer with a thin coating of ice, and then exposing it in that state over a cup of sulphuric acid, under an exhausted receiver; but the experiment was unsuccessful; for, though the reduction of temperature was considerable, the mercury, owing to the imperfection of the air-pump, was not frozen. Soon after, however, he had an opportunity of trying the experiment a second time, with the very excellent air-pump constructed by Miller and Adie already mentioned, when he had the high gratification of realizing his conjecture, and seeing the mercury in the bulb of the thermometer partially congeal. For the sake of those who may wish to attempt this very beautiful experiment, we may mention, that the air-pump should be sufficiently powerful to bring the gage within $\frac{1}{15}$th of an inch at least of the barometrical column, at the time of the experiment; and that the sulphuric acid employed for absorbing the vapour of the ice, should be in the most concentrated state in which it can be procured. The crust of ice which enveloped the bulb of the thermometer in this experiment of Mr Leslie, was attached to it, by suspending the instrument from a rod, which passed through a collar of leather on the top of a receiver, and then alternately immersing the bulb in a cup of water, and exposing it, in circumstances already mentioned, to the cooling influence of evaporation in a partial vacuum. The cup of water was placed immediately under the bulb for the conveniency of the immersions, and removed from the receiver when the crust of ice on the bulb was sufficiently thick. The bulb with its coat of ice was then suspended about an inch above the cup containing the sulphuric acid, and the receiver was exhausted, until the gage was brought to within $\frac{1}{30}$th of an inch of the height of the barometrical column, at the time of the experiment. After the experiment had been allowed to proceed during half an hour, a sudden contraction was observed in the mercury; the air was re-admitted, and the thermometer being withdrawn as quickly as possible, it was found, on breaking the bulb, that a small portion of the mercury was actually in a solid state.

We have performed this experiment with the same air pump, by arranging the apparatus a little differently, and with a more decisive result, as the congelation of the mercury was more rapid and complete. The principal difficulty in Mr Leslie's mode of performing the experiment, is experienced in giving the coating of ice to the thermometrical bulb. We avoided this, by taking a lump of solid ice, and giving it, by means of a piece of hot iron, the shape of a cup about $\frac{1}{8}$th of an inch thick. This cup was suspended in net-work, about an inch above the sulphuric acid. The mercury to be frozen, which was previously reduced to 32°, to prevent it from melting the bottom of the cup, was poured into it, and then covered with a shallow stratum of water, about the same depth as the thickness of the cup. The whole was covered with a receiver, and the air was exhausted as quickly as possible. The water above the mercury was immediately frozen, so that the mercury was completely enveloped in ice, and in contact with it. The air of the room was about 60°, and the gage was brought within $\frac{1}{15}$th of an inch of the height of the barometrical column. In about 3 minutes, the ice began to exhibit an evident appearance of a rapid waste by evaporation, its surface becoming rugged and uneven. It then cracked in several places and discovered part of the mercury, which seemed to be in the solid state. At the end of 6 minutes, the air was re-admitted, and the cup of ice being taken out of the receiver and broken, the mercury was found to be completely solid. It sustained repeated blows of a hammer, and appeared to possess an imperfect degree of malleability. A part of it being thrown into water, was immediately surrounded with a shell of ice.

Production of cold by liquefaction.

The third method of producing cold which we proposed to consider, is liquefaction induced by chemical action. We have already explained (see CHEMISTRY, page 42) the general principles upon which the reduction of temperature by liquefaction depends. We shall now give a more detailed and practical view of the subject.

The solution of salts in water, by the transition to the fluid state, is always accompanied with a considerable diminution of temperature. When nitre is added to water, at the ordinary temperature of the atmosphere, until the water is saturated, the temperature is reduced 15 or 16 degrees; and a still greater degree of cold is obtained by the solution of muriate of ammonia. But of all the salts, nitrate of ammonia seems to undergo the greatest reduction of temperature during its solution. If it be mixed, in the state of a fine powder, with an equal weight of water, the temperature is reduced from 50° to 4°.

Solution of salts in water.

The greatest number of experiments on this subject, have been made by Mr Walker of Oxford. Being aware that water, saturated with one salt, was still capable of dissolving a portion of another, he inferred, that a greater reduction of temperature would be obtained, by dissolving different salts in succession, than by the solution of any one of them separately. The conjecture was confirmed by experiment. We have already mentioned, that nitrate of ammonia being dissolved in an equal weight of water, reduces the temperature of the ingredients from 50° to 4°; but if an equal weight of carbonate of soda be added, the temperature is reduced from 50° to 7°, though the latter salt, when employed alone with water, has but little frigorific effect.

Solution of salts in acids.

As the production of cold, by freezing mixtures, depends partly upon the rapidity with which the substances employed pass into the liquid state, and partly upon the increase of capacity for caloric which is acquired by that transition, it might be expected that a greater reduction of temperature would be obtained, by dissolving salts in acids than in water. Accordingly, by dissolving a pound and a half avoirdupois of Glauber's salts (sulphate of soda) in 12 ounces of nitrous acid, previously diluted with 6 ounces of water, Mr Walker obtained a diminution of temperature from 50° to —1°; when sulphuric acid, diluted in the same proportion, was employed, the reduction was from 50° to 5°; and three parts of the same salt by weight reduced to a fine powder, and dissolved in two parts of muriatic acid, sunk the thermometer from 50° to zero. The reduction of temperature is still greater, when different salts are employed at the same time. Thus, nitrate of ammonia 6 parts, phosphate of soda 9 parts, and diluted nitrous acid 4 parts, all by weight, reduce the temperature of the mixture from 50° to —21°. This is a diminution of 71°, and is the greatest degree of cold that can be procured by a single mixture yet known. Mr Walker succeeded in freezing mercury, by cooling, in a succession of these mixtures, the ingredients by whose liquefaction the congelation was ultimately to be produced, though the temperature of the air at the commencement of the experiment was 45°. Thus, let the mixtures be represented by A, B, C, D: the ingredients for the mixture B were cooled by A; those for C by B; and lastly, those for D by C; so that the ingredients for the last mixtures were at a very reduced temperature, before they were exposed to mutual action with one another.

When ice or snow is dissolved in acids, the solution takes place very rapidly, and is accompanied with a great reduction of temperature. The degree of cold obtained varies with the acids, and even with the state of concentration in which they are employed. Lowitz has ascertained, that, in the undiluted state, muriatic acid produces the greatest cold, nitrous the next, and sulphuric acid the least; the first reducing the temperature from 32° to —29°, the second to —22°, and the third to —11° of Fahrenheit. Sulphuric acid, however, when it is diluted with water, has a more powerful effect than either of the other two. Contrary to what we should have expected, if the acids be cooled so low as to be congealed, they produce, when added in that state to snow, a smaller reduction of temperature than they produce when liquid. The diminution of effect is probably to be ascribed to the solution taking place more slowly.

Solution of snow in acids.

A much greater degree of cold is obtained from the action of the salts with ice or snow, than when these substances are simply dissolved in water. A mixture of snow and common salt, reduces the thermometer to zero on the scale of Fahrenheit. As this was the greatest degree of cold known at the time, when that artist proposed his division of the thermometrical scale, it was conceived to be a very fit point for the commencement of the graduation. It has been ascertained, however, that several other salts have a much greater refrigerating effect, and that some of them produce a cold which is upwards of 70° below that point. The reason why the salts cause a greater reduction of temperature with ice or snow than with water, is evidently the great absorption of caloric which takes place during the liquefaction of the ice or snow, in consequence of the increased capacity in a liquid state.

Having considered the various methods of producing cold by liquefaction, we shall now subjoin a list of the most powerful of the freezing mixtures, the materials to be employed being taken by weight.

Table of Freezing Mixtures.

Table of freezing mixtures.

	Parts.	Reduction of Temperature.
Muriate of Ammonia,	5	from 50° to 10°
Nitre,	5	
Water.	16	
Muriate of Ammonia,	5	50 to 4
Nitre,	5	
Sulphate of Soda.	8	
Water.	16	
Nitrate of Ammonia,	1	50 to 4
Water.	1	
Sulphate of soda,	8	50 to 0
Muriatic acid.	5	
Sulphate of soda,	3	50 to — 3
Sulphuric acid diluted with an equal weight of water.	4	
Sulphate of soda,	3	50 to — 3
Nitrous acid diluted with an equal weight of water.	2	
Nitrate of ammonia,	1	50 to — 7
Carbonate of soda,	1	
Water.	1	
Sulphate of soda,	6	50 to —10
Muriate of ammonia,	4	
Nitre,	2	
Diluted nitrous acid as above.	4	
Phosphate of soda,	9	50 to —12
Diluted nitric acid,	4	
Sulphate of soda,	6	50 to —21
Nitrate of ammonia,	5	
Diluted nitrous acid,	4	
Muriate of soda,	1	32 to — 5
Snow,	2	
Dry carbonate of ammonia,		32 to — 6
Snow,		
Diluted nitrous acid,		32 to —10
Snow,		
Concentrated sulphuric acid,		32 to —10½
Snow,		
Muriate of soda,	2	32 to —12
Muriate of ammonia,	1	
Snow,	5	
Soda crystallized,		32 to —15
Snow,		
Potash, pure, and deprived of its water of crystallization,		32 to —15
Snow,		
Concentrated acetous acid,		32 to —17
Snow,		
Carbonate of potash,		32 to —17
Snow,		
Nitrate of lime,		32 to —17
Snow,		
Muriate of soda,	10	32 to —18
Nitre,	5	
Snow,	24	
Sulphuric acid diluted with half its weight of water,	2	32 to —23
Snow,	3	
Muriate of soda,	5	32 to —25
Nitrate of ammonia,	5	
Snow,	12	
Muriatic acid concentrated,	5	32 to —27
Snow,	8	
Nitrous acid concentrated,	4	32 to —30
Snow,	7	
Muriate of lime,	5	32 to —40
Snow,	4	
Muriate of lime,	3	32 to —50
Snow,	2	
Muriate of lime,	5	32 to —53
Snow,	3	
Muriate of lime,	2	0 to —66
Snow,	1	
Muriate of lime,	3	40 to —73
Snow,	1	
Sulphuric acid diluted with half its weight of water;	10	68 to —91
Snow,	8	

The mixtures in which the proportion of the ingredients are omitted, have been proposed by Lowitz: the materials are probably meant to be employed in equal quantities.

The salts employed should neither be in an efflorescent state, nor contain an excess of water of crystallization; and after being reduced to powder, they should be mixed as quickly as possible with the other materials. In those mixtures in which snow is used, the snow answers the purpose best when it has fallen during frosty weather, and is in a dry pulverulent state. In all cases, the proper proportion of the materials should be carefully observed; an excess of any of them is so much superfluous matter to be cooled down, and must diminish the effect.

Mr Hutton's experiments on the freezing of alcohol.

A cold still more intense than can be procured by any of the freezing mixtures mentioned in the preceding Table has lately been obtained by Mr Hutton, a gentleman in Edinburgh. He has not thought proper to communicate to the public the processes of refrigeration which he has employed; but the results of the cold he obtained, indicate a much greater reduction of temperature than has hitherto been known.

"Directing my attention to this subject," says Mr Hutton, "in the summer of 1810, a method occurred to me, by which I imagined a greater degree of cold might be produced than had hitherto been obtained. Although the power of this method appeared in theory almost indefinite, yet it was easy to foresee, that in practice many circumstances might at first concur to set limits to its application; from the nature of these circumstances, however, it was to be expected that some of them might be considerably modified, and many of them might in time be altogether removed, and thus the practice made in some degree to approximate to the theory.

At the time this method occurred to me, the pressure of my professional avocations did not allow me to prosecute it; but, as I anticipated some leisure in the following autumn, I immediately began to provide at any leisure moments I had, such apparatus as I considered absolutely necessary, or was most likely to be useful. The little dependance, however, which is to be placed on general reasoning on such subjects, and the apprehension that the method might have been previously tried, and found insufficient by others, prevented me from providing any very extensive apparatus.

My first experiment was tried in the following autumn. The thermometer was filled and sealed by myself. The tube was previously tried by the common method, and found, as nearly as such tubes are commonly to be met with, of equal calibre throughout. The spirit with which it was filled, was prepared by Richter's process, and afterwards re-distilled by itself.—Its specific gravity at 62° was 798.—The points 60° and 100° were determined by a mercurial thermometer, which had been made with the usual precautions; the interval was divided into four spaces, each of which, of course, corresponded to 10°; the part of the stem below 60° measured nearly 18 of these spaces. A mark was made at every space, till, on arriving at the end of the 17th, the graduation could not be carried farther. This point, of course, corresponded to $+60° - 170° = -110°$ of Fahrenheit's scale.

This thermometer was exposed to the cold produced by the method alluded to, and after some time was examined, when the alcohol was found to have passed all the marks, and was obviously sunk within the ball of the thermometer. A slight degree of discoloration was observable. The thermometer was replaced, and examined about five minutes afterwards, when the ball of the thermometer was found broken, and crystals adhered to the fragments.

I next took a glass tube, about 3-10ths of an inch in diameter, and sealed at one end; into this I poured alcohol till it stood in the tube 4 10ths of an inch deep, and then exposed it to the cold, produced as before; after some time, it was so completely solid, that on inverting the tube it did not drop, and only a very minute stream was perceived to glide slowly down the inside of the tube; when this stream had reached nearly the middle of the tube, the whole suddenly fell out, and, pitching in a glass, was broken into several pieces, which quickly melted.

This experiment was several times repeated, but by allowing the alcohol to remain a little longer exposed to the cold, it became so completely solid, that, on inverting the tube, not the least portion of fluid could be perceived to separate from the mass.

Mr Hutton's experiments on the freezing of alcohol.

In order to be as certain as possible of the strength of the alcohol I employed, I again took its specific gravity, and the result corresponded with what I before obtained.

These experiments, therefore, left me no room to doubt that I had frozen alcohol, which, at the temperature of 62°, is of the specific gravity 798.

Being appointed (by the Edinburgh Institute) to deliver the course of lectures on chemistry for the session 1810-11, I had no leisure at that time to pursue these experiments. They were resumed, however, in the autumn of 1811. The second experiment was repeated and varied, and solid masses of alcohol of some magnitude obtained. Some of these I soldered together, using as a hot bolt a rod of frozen mercury, and sometimes a straw cooled down to a very low temperature.

It now appeared to me to be an object of some importance, to ascertain the form of the crystals which this substance assumes. This I found attended with some difficulties which I did not anticipate, and attempts to overcome them, have led to the discovery of some facts which I did not at all expect.

The common masses exhibited crystals of different forms; two kinds appeared to predominate, and each was tolerably distinct in its kind, but it was not very easy to perceive by what increments or decrements the one could be supposed to pass into the other; a rather casual circumstance, however, explained the source of this variety. Attempting to freeze alcohol by a modification of the general process, which I conjectured would yield more regular crystals than the common method, I observed, that before crystallizing, the alchohol separated into three very distinct strata, the uppermost was of a pale yellowish green, while the second was of a very pale yellow colour. Both these strata were very thin, the last mentioned was rather the thickest; the lowermost stratum was nearly transparent and colourless, and very greatly exceeded the other two in quantity. After allowing a part of the lower stratum, which I conceived to be the pure alcohol, to freeze, I attempted to pour out the remainder, but was prevented by the upper strata, which proved to be solidified. The lowermost of these two strata bore some marks of crystallization, the upper had none, and proved so firm as to resist a straw, with which I attempted to perforate it, to open a passage for the sublatent liquid. On removing part of these superior strata, and decanting the remaining fluid, the crystals of the lower stratum appeared very distinctly to be rectangular prisms of equal planes, a few of them on one side of the glass surmounted by quadrangular pyramids, but most of them by dihedral summits. This experiment I repeated several times, and the results coincided.

In order to ascertain whether these phenomena arose from a decomposition of the alcohol, or from the separation of foreign substances previously held by it in solution, the products of several of these experiments were mingled together in a stoppered matrass; the whole was then raised to the temperature of about 120°, by a water bath of that temperature. The substances forming the different strata united together, and formed a colourless liquor, which had the specific gravity and all the other properties of the alcohol from which it was obtained. This experiment was repeated several times, and the results were uniform, affording sufficient evidence that the alcohol had not been decomposed by this process, but that the superior strata consisted of foreign substances

Mr Hutton's experiments on the freezing of alcohol.

which it had held in solution. The variety in the form of the crystals obtained by former experiments, was therefore most likely occasioned by the presence of these foreign substances, a phenomenon not uncommon in chemistry.

The result of these experiments led me now to perceive, that the assumption that alcohol, prepared by Richter's process, is perfectly pure, or at most contains only a very minute portion of water, is entirely gratuitous. The diluted alcohol of commerce, from which the more concentrated is obtained, is well known to contain different volatile impurities; and since Richter's process makes no provision for the separation of these, we ought rather to expect still to meet with some portion of them in alcohol prepared in this manner.

I next proceeded to examine the properties of the different substances into which I had separated Richter's alcohol, but the time I had now left for this purpose was too short for making much progress in this inquiry; a few only of their habitudes with water, and with one another, were all that I had time to examine; even these I could examine only imperfectly.

The lowermost stratum, or nearly colourless fluid, which I have called alcohol, had no flavour, and produced on the organ of smell only a sharp pungent sensation. It has the remarkable property of smoking when exposed to the air, and, when diluted with water, it differs considerably in taste from common diluted spirit of wine.

I have made no experiments to ascertain the specific gravity of this alcohol. It may at first sight be concluded, that, by being deprived of its impurities, which are evidently specifically lighter than it, this alcohol would have its specific gravity increased: such a conclusion, however, would be obviously rash; for, since these impurities were, without doubt, previously in combination with the alcohol, and when mixed with it again enter into that state, and since, by this kind of combination, the mean specific gravity is generally altered, most frequently increased—supposing that this combination follows the more general law, the increase may be either greater or less than the diminution occasioned by the lighter impurities; and therefore, for any thing we at present know, the specific gravity of this alcohol may be either greater or less than that of the compound from which it is obtained.

The pale yellow substance, or second stratum, has a pungent taste, leaving an impression of sweetness. It has a very strong but agreeable smell. When mixed with the alcohol, and diluted with water, it has very much the flavour of the better kinds of highland whisky. It readily dissolves in water, and communicates to that fluid its peculiar flavour.

The pale yellowish green substance which composes the uppermost stratum, has a strong and very offensive smell, and a very sharp nauseous taste. It dissolves in alcohol, to which it communicates its peculiar flavour; its disagreeable smell is considerably heightened by this combination. It dissolves in water, though less readily than the substance last treated of. The compound, when much diluted and heated, has very much the flavour of the *low wine* of our lowland distillers, at the time when it issues from the still.

The two last mentioned substances, or those of which the two upper strata are composed, when mixed together and greatly diluted with water, have very nearly the flavour of alcohol. They have rather more volatility than water; for when half of a solution of them has been distilled over, the distilled part has a much stronger smell than that which remains in the retort. The kind of smell, however, of both portions is the same, which shows that these impurities cannot be separated by distillation.

It may be proper to mention, that from the circumstance of my sense of smell having been for some time extremely obtuse, I have been under the necessity of trusting to others for the facts regarding the flavour of these new substances and mixtures. From the uniformity of the reports, however, which I have received from different persons, I have no doubt that these facts are correct.

Besides that from which I filled the thermometer in the first experiment, I have operated on alcohol of the specific gravities 802, 797, and 784. the specific gravity of the last was taken when its temperature was 66°, and it is probably the most concentrated that has ever been obtained. But with alcohol of all these different strengths, the general results were similar. In alcohol obtained from different sources, the proportions of the impurities were different, both with regard to the pure alcohol, and to one another, but I have met with none that did not contain both.

From these experiments I think it is ascertained,

1st, That the strongest alcohol which we are able to obtain, may be frozen by the method alluded to.

2d, That this alcohol contains at least two foreign substances, which are highly volatile, and, so far as is known, can only be separated by freezing.

3d, That it is to these substances that alcohol owes its peculiar flavour, and that, according as the one or other predominates, the flavour of the alcohol is agreeable or otherwise.

Last autumn (of 1812) I resumed this subject, and my attention was chiefly directed to the habitudes of these impurities with the chemical re-agents. This I found attended with considerable difficulties, none of the least of which was to procure a sufficient quantity of these impurities in a separate state. The series of experiments I proposed to myself on this subject have not yet been completed, but I may remark, that the result of some of those I have made promises to afford practical hints of considerable importance to those brewers, whose products are intended to afford spirituous liquors.

From this notice it will be observed, that I have scarcely yet entered on the wide field of inquiry, for the cultivation of which, the method alluded to appears to offer so powerful an instrument. Alcohol only has been subjected to experiment; it was the only liquid which had resisted all attempts to reduce it to the solid state by the abstraction of caloric. If these experiments be correct, we may now pronounce it a general law to which there is no exception, that all liquids with which we are acquainted, may be reduced to the solid state by a suitable abstraction of caloric. Whether all gases may be susceptible of reduction to the solid state, by the abstraction of caloric, remains to be ascertained; although, as I have mentioned, analogy renders it in the highest degree probable."

Radiation of cold.

Before finishing the consideration of artificial cold, we must offer a few remarks on a fact, the explanation of which seems to have given a great deal of difficulty to chemists,—we mean the apparent radiation of cold. The discussion of this subject is important, in a scientific point of view, from its connection with the question concerning the existence of a frigorific principle, as an antagonist to caloric. We do not pretend that we shall set this question at rest; but we are satisfied we shall be able to prove, that the existence of cold, as a separate and independent principle or condition of matter, receives no additional support from the fact of its apparent radiation.

The effect of surface in modifying the heating and cooling of bodies by radiation, has been long known; though we are indebted to Mr Leslie for the first scientific investigation of the subject. Some experiments on radiation had, indeed, been made by Lambert and Scheele, but they were extremely obvious, and have little pretensions to precision.

If a plate of polished metal be exposed to the heat of a fire, almost all the rays of caloric are reflected from its surface, and it requires but little increase of temperature. But if a pane of glass be placed in similar circumstances, the greater part of the rays are absorbed, and the pane soon becomes very warm. The same effect is produced, if the surface of the metallic plate be covered with a coating of lamp-black. From those experiments, and a variety of others which will be detailed under HEAT, it appears that the absorbing power of bodies for caloric is considerably affected by the nature of their surfaces. It is somewhat curious, that when their temperature is superior to that of the surrounding medium, or adjacent bodies, their tendency to radiate, or throw off caloric, corresponds with their disposition in the former case to absorb it; so that the absorbing and radiating power, or in common language, the tendency to heating and cooling in opposite circumstances, are equally affected by surface, and in a degree that has some relation to the distance and difference of temperature of the radiating and absorbing bodies; the radiation and absorption being carried on between them, until an equilibrium of temperature is established. It is difficult to determine, whether a mutual interchange of temperature takes place between the warmer and the colder bodies, each radiating in a degree corresponding to its quantity of caloric, or whether the radiation proceeds from the warmer body alone, and the colder body is merely a recipient of its emanations; only, if we say that one body is hot, and the other cold, we must affirm, in conformity with the ordinary acceptation of the terms, that, in the latter supposition, there is a radiation of cold as well as of heat. Thus, let the temperature of the hotter body be 60° of Fahrenheit, and that of the colder 30°: if it be supposed, that a mutual communication of temperature by radiation takes place between them, we would admit without hesitation that the colder body radiates cold; or, if it be supposed that the temperature of the one is 30°, and that of the other 20°, and that the radiation proceeds solely from the body at the more elevated temperature, we might still say that the emanations were cold. But if the temperature of the hotter body were 120°, and that of the colder 60°, we would scarcely be disposed to admit that the latter radiated cold, even on the supposition of a reciprocal exchange of temperature. In those instances, however, it is obvious that we assume our own feelings as the standard of reference; and though, in the discussion of the radiation of cold, this circumstance has been sometimes brought into view, we suspect it has been too little regarded; and that it has contributed, either directly or indirectly, to produce all the obscurity in which the radiation of cold is at present involved. If we reject entirely the decision of our feelings, as vague and fallacious, and have recourse to the less objectionable means of describing the degrees of temperature by the expansion and contraction of bodies, we shall be compelled to acknowledge, that as we are still ignorant of the true zero, or the point of total privation of temperature, we cannot, in any case, pronounce with certainty whether the radiation be of a calorific or frigorific nature. Nay as we judge ultimately of the reduction of temperature in every case by the contraction of bodies, it is evident that so long as this contraction takes place, we must infer that caloric is abstracting from them; and as this may continue to go on until the bodies are reduced to mere physical points, the true zero and the annihilation of matter must be coincident; in other words, matter cannot exist without having a certain temperature, or a certain degree of caloric is essentially connected with it from its very nature. If this view of the subject be just, the opinion of the radiation of cold must be rejected, as founded entirely on the vague use of the terms which we apply to the radiation of temperature in different circumstances, and which, by a slight change of these, may become a radiation of caloric.

The total privation of temperature seems to imply an impossibility or at least the annihilation of matter.

Several experiments, however, have been adduced, which seem to afford the same evidence for the existence of a frigorific principle, that we have of caloric. These experiments are all connected with radiation or absorption: after describing them, we shall state the hypotheses which have been proposed to explain them, in conformity with the opinion that cold is merely the abstraction of caloric.

We have already mentioned, that when a plate of polished metal is exposed to a heated body, almost all the rays of caloric are reflected. If the rays strike the surface of the plate perpendicularly, they are reflected directly backwards; but if they strike it obliquely, they are also reflected obliquely; and the angle of reflection, as in the case of light, is equal to the angle of incidence. Such a figure, therefore, might be given to the metallic surface, that when the heated body to which it is exposed is placed in a certain position, all the rays incident upon it might be reflected in a direction parallel to each other. This will be the case if the metallic reflector have the surface of a parabolic conoid, and the hot body be placed in the focus of the generating parabola. Accordingly, if another mirror of the same form be placed directly opposite, the foci being turned towards each other, and the axes coincident, the emanations from the hot body in the one focus will meet, after two reflections, in the other, and produce there an elevation of temperature corresponding to that of the hot body. If the surface of the reflectors be coated with lamp black, the effect is scarcely perceptible, because almost all the rays of caloric are then absorbed. In short, the greatest effect is produced, when the surface of the hot body is most favourable to radiation, the temperature being supposed the same; and when the reflectors are most highly polished, and formed of some metal which has the least disposition to absorb caloric.

Experiment of Pictet.

It was ascertained by Pictet, with an apparatus similar to the one we have described, that when a matrass filled with snow was placed in the one focus, and a delicate air thermometer in the other, the reflectors being at the distance of 10½ feet, the thermometer immediately indicated a reduction of temperature of several degrees, and rose again when the matrass was withdrawn. On replacing the matrass, and pouring nitrous acid upon the snow, the temperature of the thermometer sunk 5° or 6° lower than before. In this experiment, cold seems to have been radiated by the snow, and after being reflected from the surface of each mirror, to have been absorbed by the thermometer; and hence the reduction of temperature which it sustained.

Experiments of Mr Leslie.

In order to ascertain the nature of this radiant cold, Mr Leslie, who has particularly investigated the subject by experiment, took a tin cubical vessel, having one side painted with lamp black, another coated with writing paper, a third covered with a pane of glass, and the fourth bright and polished: he filled the vessel thus prepared with ice, and having opposed it to the thermometer in the focus of one of the reflectors, he found the reduction of temperature sustained by the thermometer to be least from the metallic surface, greater from the pane of glass, and greatest of all from the side coated with lamp-black. From a variety of other experiments, he ascertained, that the powers of different substances in radiating, reflecting, and absorbing cold, are precisely the same as their powers of radiating, reflecting, and absorbing heat. Hence, it has been concluded, that we have the same proofs for the existence of cold as a distinct and independent principle, that we have for the existence of heat.

Explanation of the apparent radiation of cold by Prevost.

The explanation of these facts, in conformity with the doctrine that cold is merely a negation of heat, has given greater difficulty to chemists than we conceive belongs naturally to the subject. According to the hypothesis of Prevost, caloric is radiated from all bodies at all temperatures, the quantity radiated being proportional to the difference of temperatures. When the body placed in the focus of one of the reflectors has a more elevated temperature than the thermometer in the focus of the opposite reflector, the temperature of the thermometer is increased, because it receives more caloric by absorption, than it communicates by radiation. When both the body and the thermometer are at the same temperature, no change takes place, because each communicates the same quantity which it receives; but if the temperature of the body be lower than that of the thermometer, though it still radiates caloric, it radiates a smaller quantity than the thermometer, and therefore the temperature of the latter is reduced.

Objections to it.

This explanation, depending upon the assumed principle, that bodies, at all temperatures, radiate caloric in a degree proportional to the quantity of that power which they contain, is totally inconsistent with the most obvious facts attending the cooling of bodies. For, if it were true that a mutual participation of temperature takes place between the hotter and the colder body, until they arrive at the same temperature, and that this reciprocal action even goes on after an equilibrium is established between them, it is evident that a hot body ought to cool more slowly when it is placed near a large body of inferior temperature, than near a small one; because, in the former case, (as we must suppose, that if a body radiates at all, the radiation will at least be proportional to its surface), it must receive more calorific emanations than in the latter; and this, of course, ought to retard its cooling. But the fact is precisely the reverse. It is also very properly objected to this explanation by Mr Murray, that "of different surfaces, which at a given temperature radiate different quantities of caloric, that which radiates least must be least powerful in returning caloric to the thermometer, and must therefore have least effect in counteracting the reduction of its temperature; in other words, must produce the greatest cold. From Mr Leslie's experiments, it is fully established, as has been already stated, that a blackened surface is that which, at a given temperature, radiates the largest quantity of caloric, and a metallic surface that which radiates least. Were Prevost's explanation just, therefore, the blackened surface is the one which, in the experiment on radiant cold, ought to produce the least cooling effect on the thermometer, and the metallic surface the greatest." Rejecting, therefore, this explanation of Prevost, we shall proceed to consider that of Pictet.

Explanation of Pictet.

According to this philosopher, the particles of caloric have a repulsion to each other, which increases as the distance between them diminishes. They therefore tend to recede from each other with a force proportioned to the degree of their accumulation in the same body, and separate, until they are counteracted by caloric in other bodies, of the same density or elasticity with themselves. So that, if this hypothesis be well-founded, the term *equilibrium* of temperature may be applied with strict propriety to the equal distribution of it, as being, in reality, the balancing of equal and opposite forces. But if a body, at a lower temperature, be introduced among a system of bodies in this state of equilibrium, the particles of caloric of the colder body are forced to approach nearer to each other by the more powerful elasticity of the caloric of the hotter bodies; a fresh supply enters to occupy the space which they had left; and the balance of tension being again restored, an equilibrium of temperature is quickly established. When a cold body is placed in the focus of one of the reflectors, the equilibrium of temperature of the surrounding bodies is subverted, and caloric immediately rushes towards it from every side. The adjacent surface of the reflector is thus deprived of a portion of its caloric, and the deficiency is partially supplied by the opposite reflector. This reflector, in its turn, begins to act upon the thermometer, which, by this series of radiations and absorptions successively repeated, is drained of its caloric, and reduced in temperature. This explanation, though free from the objections which we have stated against the hypothesis of Prevost, is irreconcileable with the fact, that the greatest reduction of temperature is produced in the thermometer, when the reflectors are in the most unfavourable state for radiation and absorption, the effect in similar circumstances being greatest when the reflectors are well polished and resplendent. But if the theory were just, it is obvious that the very reverse would be the case; and that the greatest apparent radiation of cold would be exhibited when the surface of the reflectors were covered with a coating of lamp-black; because, in that state, they possess the greatest radiating and absorbing power, whereas the effect is then barely perceptible. This theory is therefore equally inadmissible with the former.

Objections to it.

The theory of Prevost not more inapplicable to the experiments with the reflectors, than to ordinary radiation.

With respect to the theory of Prevost, we may remark, that the same objection may be urged in applying it to the most simple case of cooling,—that of a thermometer being reduced in temperature when it is placed near a cold body, as in the experiments with the reflectors. The truth is, that as the only effect of the reflectors is to change *mechanically* the direction of the emanation, and thus establish a communication between the remote sides of the cold body and the thermometer, there is no greater difficulty in accounting for the reduction of the temperature of the thermometer in these circumstances, than when a thermometer is cooled directly in consequence of its proximity to a cold body. So that the objection of Mr Murray against this theory, that the reduction of the temperature of the thermometer was greatest, when the surface of the cold body was most favourable to radiation, may be applied with equal force to the simplest case of radiation we can suppose. The imperfection of Prevost's theory does not consist, therefore, merely in its insufficiency to explain the experiments with the reflectors, but in its being equally inapplicable to explain the phenomena attending the changes of temperature by direct and immediate radiation.

Modification of Pictet's theory.

With regard to the explanation advanced by Pictet, the objections to which it is liable in its present form, might, in some measure, have been avoided, by taking a different view of the action of the mirrors. The general theory which he has proposed for explaining the processes of the heating and cooling of bodies, does not necessarily imply that the mirrors shall act solely by absorption and radiation; and, indeed, the author of the theory seems to have adopted that view of the subject, from the difficulty which he had found of accounting for the emanations proceeding from the thermometer, when its temperature was the same as that of the surrounding medium. According to Pictet's hypothesis, if two equal and similar bodies, at the same reduced temperature, were placed, one in the focus of each reflector, they would have no effect upon each other, as the elasticity of the calorific fluid in both being exactly balanced, the equilibrium of temperature would be maintained between them. But if a hot body, as a thermometer, were substituted for one of the cold bodies, the equilibrium would immediately be subverted; and the caloric of the thermometer diffusing itself by its superior elasticity, would rush towards the adjacent mirror, undergo reflection at its surface, and proceed in parallel lines to the opposite mirror, where it would suffer a second reflection, and at last be absorbed by the cold body. Of course, the temperature of the thermometer would be reduced, and thus indicate the appearance of the radiation of cold from the cold body.

Without adopting the explanation either of Prevost or Pictet, or advancing any hypothesis of our own on the subject, we shall deem it sufficient to shew that the results of the experiments with the reflectors afford no argument for the support of any theory, which might not be derived from direct radiation and absorption.

Attempt to shew that the experiments with the reflectors, furnish no new argument for the radiation of cold.

Plate CXCIX. Fig. 5.

That we may begin with the simplest case, let it be supposed that the body A, Plate CXCIX, Fig. 5, is surrounded on every side with bodies at an inferior temperature: it will immediately begin to throw off rays of caloric in all directions, and if the surrounding bodies be regularly and uniformly disposed, and have the same absorbing powers for caloric, it will cool equally on every side. If another body B, in every respect similar to A, at a temperature considerably lower than that of the other bodies, be now placed at no great distance from A, the body A will cool more rapidly than before, particularly on the side adjacent to B; and still more rapidly if the surfaces *a d*, and *f h*, possess great radiating or absorbing powers. Since the cooling of A is promoted by the nature of the surface *f h* of B, and since those surfaces which radiate caloric most powerfully, also absorb it in the same degree in opposite circumstances, it is obvious, that any hypothesis which assumes, that emanations proceed mutually from one body to the other, during the process of cooling, must have the same difficulty in explaining why, in the present case, A is more rapidly reduced in temperature, when the radiation from B ought to be most abundant, as it would have in similar circumstances with the reflectors. Consequently, the objections which we urged against Prevost's theory, deduced from the experiment with the reflectors, that the greatest depression of the thermometer is exhibited when the surface of the cold body, placed in the focus of one of the reflectors, is most favourable to radiation, apply with equal force in cases of cooling by direct radiation and absorption.

Let us now suppose that the radiations from the side *b c*, instead of being allowed to proceed from it in their ordinary course, are intercepted by some reflecting surface, and thrown back in the same direction with the perpendicular emanations from the opposite side *a d*; as this reflection can have no effect on the physical qualities of the emanations, but merely to change their direction, the only consequence of the arrangement we have supposed will be to retard slightly the cooling of A, by the partial re-absorption of those rays which are thrown back upon *b c*. If we further suppose, that the reflected emanations now moving parallel to one another, are again intercepted by a reflecting surface placed behind B, and thrown by means of its figure upon the surface *e g*, the same effect must now be produced on this surface as if there had been a direct radiation towards it from *b c*. Indeed, it might be inferred, *à priori*, that as the only function of the reflecting surfaces is to change the direction of the incident rays, we have no reason to expect, when they are employed, any effect different from that which is obtained by immediate and direct radiation.

We accordingly find, that the greatest effect is produced in diminishing the temperature of A, when the surfaces *b c* and *e g* are best fitted to radiate and absorb the calorific rays, just as we found the same thing to hold by direct radiation, when the surfaces *a d* and *f h* were in like circumstances. It is evident, therefore, that the rapid cooling of a hot body, when it is placed in the focus of a reflector by means of a cold body placed in the focus of an opposite reflector, admits of being explained upon any hypothesis which affords a satisfactory explanation of the simplest case of cooling, that by direct radiation; and that the experiments with the reflectors furnish no argument in support of the doctrine of a frigorific principle of which we were not previously in possession.

Natural cold.

The degrees of natural cold which occur in the more inhospitable regions of the globe, are far surpassed by the reductions of temperature obtained by artificial means. The greatest cold that has hitherto been observed in the open air, does not exceed —50; and probably the extreme range of the inferior temperatures which occur in nature, is but little below that point.

The temperature of a particular place on the surface of the earth is determined by a variety of circumstances, some of which are regular in their operation, others accidental. Among the former of these, may be stated, the direct influence of the solar rays, and the latitude; among the latter, the winds, evaporation, and perhaps the evolution or absorption of heat by operations going on in the central regions. Even the causes of temperature which we have denominated regular, are not absolutely so: the heat produced by the rays of the sun may be affected by spots upon his surface; and the temperature resulting from geographical position may be modified by local peculiarities. Thus the sea limits the range of temperature, by moderating alike the extremes of heat and cold; while large tracts of land are equally favourable to both. The winds have a very powerful influence on the temperature of a place. When the surface of the earth is much heated by the influence of the solar rays, the air immediately above it is rarified, and becoming specifically lighter, ascends into the higher regions of the atmosphere. Its place is quickly occupied by a fresh portion of air rushing in from every side, which, in its turn, being heated and rarified, also ascends. The warm air which has thus ascended, is gradually wafted to colder regions, where it gives out its heat, and moderates the rigour of the climate to which it has been transported.

Remarkable change on the climate of Europe.

Evaporation is one of the principal sources of natural cold, the conversion of water into vapour being necessarily accompanied with the absorption of much caloric; hence, the agricultural improvement of a country, or whatever tends to facilitate the escape of the water from its surface by any means but evaporation, has a remarkable influence on its temperature. The gradual amelioration of the climate of America, is undoubtedly to be ascribed to this cause, as well as that of Europe. Hume, in his *Essay on the Populousness of Ancient Nations*, has proved, by the most ample authorities, that a very great change has taken place on the general temperature of Europe since no very distant period: "It is an observation of L'Abbe de Bos," says he, "that Italy is warmer at present than it was in ancient times. The annals of Rome tell us, that in the year 480 *ab* U. C. the winter was so severe that it destroyed the trees; the Tyber froze at Rome, and the ground was covered with snow for forty days. When Juvenal describes a superstitious woman, he represents her as breaking the ice of the Tyber, that she might perform her ablutions:

> *Hybernum fracta glacie descendet in amnem,*
> *Ter matutino Tyberi mergetur.*

He speaks of that river's freezing as a common event. Many passages of Horace suppose the streets of Rome full of snow and ice. We should have more certainty with regard to this point, had the ancients known the use of thermometers; but their writers, without intending, give us information sufficient to convince us, that the winters are now much more temperate at Rome than formerly. At present, the Tyber no more freezes at Rome than the Nile at Cairo. The Romans esteem the winter very rigorous, if the snow lie two days, and if one see, for eight-and-forty hours, a few icicles hang from a fountain that has a north exposure.

"The observation of this ingenious critic," continues Hume, "may be extended to other European climates. Who could discover the mild climate of France in Diodorus Siculus's (lib. iv.) description of that of Gaul? As it is a northern climate,' says he, 'it is infested with cold to an extreme degree. In cloudy weather, instead of rain there fall great snows; and in clear weather, it there freezes so excessive hard, that the rivers acquire bridges of their own substance; over which, not only single travellers may pass, but large armies, accompanied with all their baggage and loaded waggons. And there being many rivers in Gaul, the Rhone, the Rhine, &c. almost all of them are frozen over; and it is usual, in order to prevent falling, to cover the ice with chaff and straw at the places where the road passes. *Colder than a Gallic winter*, is used by Petronius as a proverbial expression. Aristotle says, (*De Generat. Anim.* lib. ii.) that Gaul is so cold a climate that an ass could not live in it.

"North of the Cevennes," says Strabo, (lib. iv.) "Gaul produces not figs and olives; and the vines which have been planted bear not grapes that will ripen.

"Ovid (*Trist.* lib. iii. eleg. 9.) positively maintains, with all the serious affirmation of prose, that the Euxine sea was frozen over every winter in his time; and he appeals to Roman governors, whom he names, for the truth of his assertion. This seldom or never happens at present in the latitude of Tomi, whither Ovid was banished. All the complaints of the same poet seem to mark a rigour of the seasons, which is scarcely experienced at present in Petersburgh or Stockholm.

"Tournefort, a *Provençal*, who had travelled into the same country, observes, that there is not a finer climate in the world; and he asserts, that nothing but Ovid's melancholy could have given him such dismal ideas of it. But the facts mentioned by that poet, are too circumstantial to bear any such interpretation.

"Italy, says Varro, (lib. i. cap. 2.) is the most temperate climate in Europe. The inland parts, (Gaul, Germany, and Pannonia, no doubt,) have almost perpetual winter.

"The northern parts of Spain, according to Strabo, (lib. iii.) are but ill inhabited, because of the great cold."

These extracts afford the most satisfactory evidence, that the climate of Europe is much milder than it was in ancient times. The difference is undoubtedly owing to the partial clearing of the woods, and the land being better cultivated now than formerly; so that the superfluous water, which at that time was carried off in a great measure by evaporation, is conveyed away by drains and canals.

The winter cold of the northern parts of Europe is still more than sufficient to freeze mercury. The congelation of this metal by natural cold, was first observed at Krasnojark, in lat. 56° 30′, long. 93° east. Mercury is said to have been sometimes frozen at Quebec, in lat. 47°.

The following narrative, written by Captain Middleton, F. R. S. contains so minute a description of the effects of natural cold during winter at Churchill's river, in Hudson's Bay, and is so applicable to the general effects of cold in other places, that we shall make no apology for giving it in his own words.

Account of the winter cold at Hudson's Bay.

"The lakes and standing waters, which are not above 10 or 12 feet deep, are frozen to the ground in winter, and the fishes therein all perish.

Yet in rivers near the sea, and lakes of a greater depth than 10 or 12 feet, fishes are caught all the winter, by cutting holes through the ice down to the water, and therein putting lines and hooks. But if they are to be taken with nets, they cut several holes in a straight line the length of the net, and pass the net, with a stick fastened to the head-line, from hole to hole, till it reaches the utmost extent; and what fishes come to these holes for air, are thereby entangled in the net; and these fishes, as soon as brought into the open air, are instantaneously frozen as stiff as stock-fish. The seamen likewise freshen their salt provisions, by cutting a large hole through the ice in the stream or tide of the river, which they do at the beginning of winter, and keep it open all that season; in this hole they put their salt meat, and the minute it is immersed under water, it becomes pliable and soft, though before its immersion it was hard frozen.

Meat preserved by being frozen.

Beef, pork, mutton, and venison, that are killed at the beginning of winter, are preserved by the frost for six or seven months, entirely free from putrefaction, and prove tolerably good eating. Likewise geese, partridges, and other fowl, that are killed at the same time, and kept with their feathers on and guts in, require no other preservative but the frost to make them good wholesome eating, as long as the winter continues. All kinds of fish are preserved in the like manner.

In large lakes and rivers, the ice is sometimes broken by imprisoned vapours; and the rocks, trees, joists, and rafters of our buildings, are burst with a noise not less terrible than the firing of a great many guns together. The rocks which are split by the frost, are heaved up in great heaps, leaving large cavities behind; which I take to be caused by imprisoned watery vapours, that require more room when frozen, than they occupy in their fluid state. Neither do I think it unaccountable, that the frost should be able to tear up rocks and trees, and split the beams of our houses, when I consider the great force and elasticity thereof. If beer or water is left in mugs, cans, or bottles, nay in copper pots, though they were put by our bedsides, in a severe night they are surely split to pieces before morning, not being able to withstand the expansive force of the inclosed ice.

Effect of the frost on the glasses of telescopes.

The air is filled with innumerable particles of ice, very sharp and angular, and plainly perceptible to the naked eye. I have several times, this winter, tried to make observations of some celestial bodies, particularly the immersions of the satellites of Jupiter, with reflecting and refracting telescopes; but the metals and glasses, by that time I could fix them to the object, were covered a quarter of an inch thick with ice, and thereby the object rendered indistinct, so that it is not without great difficulties that observations can be taken.

Bottles of strong beer, brandy, strong brine, spirits of wine, set out in the open air for three or four hours, freeze to solid ice. I have tried to get the sun's refraction here to every degree above the horizon, with Elton's quadrant, but to no purpose, for the spirits froze almost as soon as brought into open air.

The frost is never out of the ground, how deep we cannot be certain. We have dug down 10 or 12 feet, and found the earth hard frozen in the two summer months; and what moisture we find five or six feet down, is white like ice.

The waters or rivers near the sea where the the current of the tide flows strong, do not freeze above 9 or 10 feet deep.

All the waters we use for cooking, brewing, &c. is melted snow and ice. No spring is yet found free from freezing, though dug never so deep down.

All waters inland are frozen fast by the beginning of October, and continue so till the beginning of May.

The walls of the house we live in are of stone, two feet thick; the windows very small, with thick wooden shutters, which are close shut 18 hours every day in the winter. There are cellars under the house, wherein we put our wines, brandy, strong beer, butter, cheese, &c. Four large fires are made in great stoves, built on purpose, every day. As soon as the wood is burnt down to a coal, the tops of the chimneys are close stopped with an iron cover; this keeps the heat within the house, (though at the same time the smoke makes our heads ache, and is very offensive and unwholesome); notwithstanding which, in four or five hours after the fire is out, the inside of the walls of our houses and bed-places will be two or three inches thick with ice, which is every morning cut away with a hatchet. Three or four times a day we make iron shot of 24 pounds weight red-hot, and hang them up in the windows of our apartments. I have a good fire in my room the major part of 24 hours, yet all this will not preserve my beer, wine, ink, &c. from freezing.

For our winter dress, we make use of three pair of socks of coarse blanketing or duffield for the feet, with a pair of deer skin shoes over them; two pair of thick English stockings, and a pair of cloth stockings upon them; breeches lined with flannel; two or three English jackets, and a fur or leather gown over them; a large beaver cap, double, to come over the face and shoulders, and a cloth of blanketing under the chin; with yarn gloves, and a large pair of beaver mittings hanging down from the shoulders before, to put our hands in, which reach up as high as our elbows; yet notwithstanding this warm cloathing, almost every day, some of the men that stir abroad, if any wind blows from the northward, are dreadfully frozen; some have their arms, hands, and face blistered and frozen in a terrible manner, the skin coming off soon after they enter a warm house, and some have lost their toes. Now their lying-in for the cure of these frozen parts, brings on the scurvy in a lamentable manner. Many have died of it, and few are free from that distemper. I have procured them all the helps I could, from the diet this country affords in winter, such as fresh fish, partridges, broths, &c. and the doctors have used their utmost skill in vain; for I find nothing will prevent that distemper from being mortal, but exercise and stirring abroad.

Coronæ and *parhelia*, commonly called Halo's, and mock-suns, appear frequently about the sun and moon here. They are seen once or twice a week about the sun, and once or twice a month about the moon, for four or five months in winter, several coronæ of different diameters appearing at the same time.

I have seen five or six parallel coronæ concentric with the sun several times in winter, being for the most part very bright, and always attended with parhelia or mock-suns. The parhelia are always accompanied with coronæ, if the weather is clear; and continue for several days together, from the sun rising to his setting. These rings are of various colours, and about forty or fifty degrees in diameter.

The frequent appearance of these phænomena in this frozen clime seems to confirm Descartes's hypothesis, who supposes them to proceed from ice suspended in the air.

The aurora borealis is much oftener seen here than in England; seldom a night passes in winter free from their appearance. They shine with a surprising brightness, darkening all the stars and planets, and covering the whole hemisphere: their tremulous motion from all parts, the beauty, and lustre, are much the same as in the northern parts of Scotland and Denmark.

The dreadful long winters here may almost be compared to the polar parts, where the absence of the sun continues for six months; the air being perpetually chilled and frozen by the northerly winds in winter, and the cold fogs and mists obstructing the sun's beams in the short summer we have here; for notwithstanding the snow and ice is then dissolved in the low lands and plains, yet the mountains are perpetually covered with snow, and incredible large bodies of ice continue in the adjacent seas.

If the air blows from the southern parts, the air is tolerably warm, but very cold when it comes from the northward; and it seldom blows otherwise than between the north-east and north-west, except in the two summer months, when we have, for the major part, light gales between the east and the north, and calms.

The northerly winds being so extremely cold, is owing to the neighbourhood of high mountains, whose tops are perpetually covered with snow, which exceedingly chills the air passing over them. The fogs and mists that are brought here from the polar parts in winter, appear to the naked eye in icicles innumerable, as small as fine hairs or threads, and pointed as sharp as needles. These icicles lodge in our clothes; and, if our faces or hands be uncovered, they presently raise blisters as white as a linen cloth, and as hard as horn. Yet if we immediately turn our backs to the weather, and can bear our hand out of our mitten, and with it rub the blistered part for a small time, we sometimes bring the skin to its former state: if not, we make our way to a fire, and get warm water, wherewith we bathe it, and thereby dissipate the humours raised by the frozen air; otherwise the skin would be off in a short time, with much hot, serous, watery matter coming from under along with the skin; and this happens to some almost every time they go abroad for five or six months in the winter, so extremely cold is the air when the wind blows any thing strong.

It is not a little surprising to many, that such extreme cold should be felt in these parts of America, more than

Reason of the cold being more intense in North America, than at places under the same parallel of latitude in Europe.

places of the same latitude on the coast of Norway; but the difference I take to be occasioned by wind blowing constantly here, for 7 months in the 12, betwteen the N. E. and N. W. and passing over a large track of land, and exceeding high mountains, &c. as before-mentioned. Whereas at Drontheim in Norway, as I observed some years ago in wintering there, the wind all the winter comes from the N. and N. N. W. and crosses a great part of the ocean clear of these large bodies of ice we find here perpetually. At this place we have constantly every year 9 months frost and snow, and insufferable cold from October till the beginning of May.

Account of Icebergs, or islands of ice on the coast of North America.

The vast bodies of ice we meet with in our passage from England to Hudson's Bay, are very surprising, not only as to quantity, but magnitude, and as unaccountable how they are formed of so great a bulk, some of them being immersed 100 fathoms or more under the surface of the ocean, and one-fifth or one-sixth part above, and three or four miles in circumference. Some hundreds of these we sometimes see in our voyage here, all in sight at once, if the weather is clear. Some of them are frequently seen on the coasts and banks of Newfoundland and New-England, though much diminished.

When I have been becalmed in Hudson's Straits, for three or four tides together, I have taken my boat and laid close to the side of one of them, sounded and found 100 fathom water all around it. The tide floweth here above four fathom; and I have observed, by marks upon a body of ice, the tide to rise and fall that difference, which was a certainty of its being aground. Likewise, in a harbour in the island of Resolution, where I continued four days, three of these isles of ice (as we call them) came aground. I sounded along by the side of one of them, quite round it, and found thirty-two fathom water, and the height above the surface but ten yards; another was twenty-eight fathom under, and the perpendicular height but nine yards above the water.

Manner in which they are formed.

I can in no other manner account for the aggregation of such large bodies of ice but this: all along the coasts of Straits Davis, both sides of Baffin's-bay, Hudson's Straits, Anticosti, or Labradore, the land is very high and bold, and 100 fathoms, or more, close to the shore. These shores have many inlets or fuirs, the cavities of which are filled up with ice and snow, by the almost perpetual winters there, and frozen to the ground, increasing four, five or seven years, till a kind of deluge or landflood, which commonly happens in that space of time throughout those parts, breaks them loose, and launches them into the straits of the ocean, where they are driven about by the variable winds and currents in June, July, and August, rather increasing than diminishing in bulk, being surrounded (except in four or five points of the compass) with smaller ice for many hundred leagues, and land covered all the year with snow, the weather being extremely cold, for the most part, in those summer months.

The smaller ice that almost fills the straits and bays, and covers many leagues up the ocean along the coast, is from four to ten fathoms thick, and chills the air to that degree, that there is a constant increase to the large isles by the sea's washing against them, and the perpetual wet fogs, like small rain, freezing as they settle upon the ice; and their being so deeply immersed under water, and such a small portion above, prevents the winds having much power to move them: for though it blows from the north-west quarter near nine months in twelve, and consequently those isles are driven towards a warmer climate, yet the progressive motion is so slow, that it must take up many years before they can get 500 or 600 leagues to the southward; I am of opinion some hundreds of years are required; for they cannot, I think, dissolve before they come between the 50th and 40th degree of latitude, where the heat of the sun consuming the upper parts, they lighten and waste in time: yet there is a perpetual supply from the northern parts, which will so continue as long as it pleases the Author of all beings to keep things in their present state."

Professor Leslie's theory of the formation of Icebergs.

A new and ingenious theory of the formation of these huge masses of ice has been recently given by Professor Leslie. As this explanation is founded on the result of a very curious experiment, we shall make no apology for giving a full account of it in Mr Leslie's own words.

"When very feeble powers of refrigeration are employed, a most singular and beautiful appearance is in course of time slowly produced. If a pan of porous earthen-ware, from four to six inches wide, be filled to the utmost with common water till it rise above the lips, and now planted above a dish of ten or twelve inches diameter, containing a body of sulphuric acid, and having a round broad receiver passed over it; on reducing the included air to some limit between the twentieth and the fifth part of its usual density, according to the coldness of the apartment, the liquid mass will, in the space of an hour or two, become entwined with icy shoots, which gradually enlarge and acquire more solidity, but always leave the fabric loose and unfrozen below. The icy crust which covers the rim, now receiving continual accessions from beneath, rises perpendicularly by insensible degrees. From each point on the rough surface of the vessel, filaments of ice, like bundles of spun glass, are protruded, fed by the humidity conveyed through its substance, and forming, in their aggregation, a fine silvery surface, analogous to that of fibrous gypsum or satin-spar. At the same time, another similar growth, though of less extent, takes place on the under side of the pan, so that continuous icy threads might appear vertically to transpierce the ware. The whole of the bottom becomes likewise covered over with elegant icy foliations. Twenty or thirty hours may be required to produce those singular effects; but the upper body of ice continues to rise for the space of several days, till it forms a circular wall of near three inches in height, leaving an interior grotto lined with fantastic groupes of icicles. In the meanwhile, the exfoliations have disappeared from the under side, and the outer incrustation is reduced, by the absorbing process, to a narrow ring. The icy wall now suffers a regular waste from external erosion, and its fibrous structure becomes rounded and less apparent. Of its altitude, however, it loses but little for some time; and even a decomposition of congealed films along its coping or upper edge, seems to take place at a certain stage of the process. This curious effect is owing to a circumstance, which, as it serves to explain some of the grand productions of nature, merits particular attention. The circular margin of the ice, being nearer the action of the sulphuric acid than its inner cavity, must suffer, by direct evaporation, a greater loss of heat; and consequently each portion of thin air that rises from the low cavity, being chilled in passing over the colder ledge, must deposit a minute corresponding share of its moisture, which instantly attaches itself and incrusts the ring. Whatever inequalities existed at first in the surface of the ice, will hence continually increase.

This explication seems to throw some light on the origin of those vast bodies of ice which occur within the Arctic Circle, and which, towering like clustered peaks above the surface of the ocean, have received the name of *icebergs.* They frequently project above an hundred feet, and must therefore have ten times as much depth concealed under water. To suppose them to have been detached from a solid field of such tremendous thickness, would seem utterly improbable. It may indeed be doubted, whether any part of the ocean be ever naturally frozen. The ice which I have formed from salt water by the frigorific process, was always incompact, inclosing brine within its interstices, and resembling the aspect of what is called water-ice, or dilute syrup congealed. Perhaps an extremely slow congelation, descending regularly from the surface, may press down the saline particles, which are never absolutely detached from the water, and thus force them to combine more largely with the mass below. But even admitting this idea, it would be still required to account for the great elevation of those icy cliffs. The most satisfactory mode, probably, of explaining the phenomenon, is to refer it to the operation of a general principle, by which the inequalities on the surface of a field of ice must be constantly increased. The lower parts of the field, being nearer the tempered mass of the ocean, are not so cold as those which project into the atmosphere, and consequently the air which ascends, becoming chilled in sweeping over the eminences, there deposits some of its moisture, forming an icy coat. But this continued incrustation, in the lapse of ages, produces a vast accumulation, till the shapeless mass is at length precipitated by its own weight.

Other natural phenomena will receive illustration from the facts disclosed by the refrigerating process. In the rigorous climes of the north, the alternations of the seasons are most rapid. On the approach of spring, the thick fields of ice which, in Russia or Canada, cover the Neva or the St Lawrence, break up with overwhelming fury, accompanied too by tremendous explosions. Nor is this noise to be ascribed to the mere crash of the falling fragments. In those frightful climates, the winter at once sets in with most intense frost, which probably envelopes the globules of air separated from the water in the act of congelation, and, invading them on all sides, reduces them to a state of high condensation. When the mild weather begins, therefore, to prevail, the body of ice, penetrated by the warmth, becomes soft and friable; and the minute but numerously interspersed globules of imprisoned air, exerting together their concentrated elasticity, produce the most violent explosive disruptions."

See Mr Leslie's *Short Account of Experiments and Instruments depending on the relation of Air to Heat and Moisture*, p. 148—153. Edinburgh, 1813. (A)

COLDENIA, a genus of plants of the class Tetrandria, and order Tetragynia. See BOTANY, p. 127.

COLEUS, a genus of plants of the class Didynamia, and order Gymnospermia. See BOTANY, p. 256.

COLERAINE, a market and borough town of Ireland, in the county of Londonderry. It is situated upon the river Bann, about three miles above its mouth, and is a tolerably large town. Considerable sums of money have been fruitlessly expended on the harbour of Coleraine, but it is merely a bar harbour, and will admit only vessels of a small burden at the time of high water. The salmon fishery at Coleraine is one of the two largest in Ireland. It belongs to the London Society, who have leased it to Irishmen, by whom it is again let at a considerable advance of rent, to a company who keeps fast sailing vessels, for the purpose of conveying the fish to Liverpool and other places. In 1796, the salmon sold at 3d. per pound, and in 1808, it was as high as 1s. 2d. Mr Wakefield visited the famous salmon leap within a mile of Coleraine, and observed the salmon springing from the water in hundreds. In 1776, about 1400 were caught at one haul.

There is also an eel fishery at Coleraine belonging to Lord Donegal, which lets at £1000 per annum; the eels are sold at 4d. per pound. The burgh of Coleraine belongs to the London Society, but the Beresford interest returns the member. The annual duties of this harbour amounted to £6000 in 1801. Population 4500. (*j*)

COLISEUM. See AMPHITHEATRE, and CIVIL ARCHITECTURE.

COLLADEA, a genus of plants of the class Triandria, and order Digynia. See BOTANY, p. 116.

COLLEGE. See ABERDEEN, ST ANDREW'S, CAMBRIDGE, EDINBURGH, GLASGOW, OXFORD, and UNIVERSITY.

COLLETIA, a genus of plants of the class Pentandria, and order Monogynia. See BOTANY, p. 156.

COLLIERY. See COAL and MINES.

COLLINS, WILLIAM, an ingenious English poet, was born in 1720 at Chichester, where his father carried on business as a hatter. He was educated on the foundation of Winchester, but missed the advantage annexed to that institution, of going off to a fellowship in New College, Oxford, as no vacancy occurred while he continued within the limited age. He went notwithstanding to Oxford, where he was first entered of Queen's College, and afterwards of Magdalen's, but remained only till he took the degree of Bachelor of Arts. Like many other poets, Collins seems to have delayed his choice of a profession till the time for chusing was past. It unfortunately happens, that the age at which this important decision should be made, is the same at which men of genius begin to discover their intellectual superiority, and in the triumph which this discovery creates, they think themselves entitled to a higher destiny than that of their companions, who content themselves with occupations requiring no unusual portion of ability. They are thus tempted to cherish indistinct though splendid visions of ambition, without calculating exactly the steps by which it is to be gratified, and they reject the employments for which they were intended, from no decided preference of any other, but from a hope that, to make their genius known, will be all that is necessary for advancing them to an eminence, which no success in an ordinary profession could confer. Such appears to have been the case with Shakespeare and Spenser, with Milton and Dryden, with Thomson and Gray, and with Chatterton and Cowper; and of all our poets, none have been richer in that originality of genius, which distinguishes its possessor from the rest of his species, than those whom we have named. This seems likewise to have been the case with Collins, whose success in college exercises seduced him into so early an application to poetry, that, before he quitted the university, he had published his Oriental Eclogues. Though the demand for these was not such as testified any extraordinary portion of public favour, yet having acquainted their author with the delight of doing that which can be done by few, and probably given him sufficient confidence in his powers, he hastened from Oxford, before the usual period of attendance was completed, to procure wealth and fame in London by his pen. His scheme, however, seems not to have been arranged with much precision, and instead of engaging in any important work, he frittered away his time in desultory exertion, designing what he never executed, and executing what he had never designed. Literary adventurers have generally been destined to a life of discomfort and perplexity; nor was Collins an exception to the common lot. Having no regular employment, he had no regular income. When pressed by the prospect of want, he resolved on diligence, but when the pressure was removed, his resolutions were forgot. Amid this fluctuation, instead of writing a history of the revival of letters, of which he frequently talked, or entering on various dramatic works, which were among the number of his projects, he contented himself with the production of a few Odes, which he seems to have composed for recreation rather than emolument. These Odes, however, abound in excellencies, to which genius alone could give existence; and justify a belief, that the uniform tranquillity derived from easy circumstances, is less propitious to the loftier flights of imagination, than the transient elasticity of spirits, which the sudden suspension of disquiet has a natural tendency to produce. Professional writers in a great city, are generally addicted to conviviality. Requiring a relaxation from labour, they prefer those evening clubs, where they meet with persons who are in a condition similar to their own, and by whom that colloquial power which they derive from their endowments, their acquirements, and their mode of life, is both excited and admired. In these assemblies of contemporary wits, Collins became acquainted with Johnson, who, says the poet, was of "a decent and manly appearance, his knowledge considerable, his views extensive, his conversation elegant, and his disposition cheerful." It was natural that a sympathy should arise between such minds as those of Collins and Johnson, while both were equally depressed by pecuniary difficulties, and elevated by a consciousness of superiority to the wealthy crowd who permitted them to starve, but over all of whom they knew themselves destined to rise, by the interest they were to create, and the renown they were to obtain. They accordingly grew into habits of such confidential intimacy, that, when the poet was skulking from an officer on the watch to arrest him, Johnson, whom he knew to be in no great security from a similar humiliation, was readily admitted to his retreat. From this embarrassment, he was relieved by a small sum which the booksellers were persuaded to advance, on his promise of writing for them a translation of Aristotle's Poetics, with a commentary. He then retired to the country, but soon after returned to town, on succeeding to a legacy of £2000, which had been left him by an uncle, and out of which he immediately relieved himself of his debt to the booksellers. This succession, to one who had been so long accustomed to indigence, appeared an inexhaustible fortune; but Providence did not permit him to enjoy it, for as he improved in circumstances, he declined in health. The malady into which he sunk, is described by Johnson as a species of insanity; but this description is afterwards qualified by a more minute detail of its symptoms, from which we are left to conclude, that it was rather nervous debility than mental derangement. "His disorder," says the biographer, "was not alienation of mind, but general laxity and feebleness, a deficiency rather of his vital than intellectual powers. What he spoke wanted neither judgment nor spirit; but a few minutes exhausted him, so that he was forced to rest upon the couch, till a short cessation restored his powers, and he was again able to talk with his former vigour. The approaches of this dreadful malady he began to feel soon after his uncle's death; and with the usual eagerness of men so diseased, eagerly snatched that temporary relief with which the table and the bottle flatter and seduce. But his health continually declined, and he grew more and more burthensome to himself." When Collins perceived this partial failure of his faculties, for a consciousness of his case seems to have been its most distressing effect, he was advised to travel, that he might divert his mind from pondering on its own decay. He therefore went to France, but as the experiment did not succeed, he speedily returned, and was for some time confined in a madhouse. He afterwards put himself under the care of a sister in Chichester, where he died at the early age of 36. It is pleasing to learn from his illustrious friend, that, amid all his afflictions, no fretfulness of spirit impelled him to abandon the endeavour of soothing them by religion. When Johnson visited him on his return from France, and found a New Testament in his hand, "I have only one book," said Collins, "but that is the best." He was buried in the cathedral of Chichester.

Of men who, like Collins, have led a life of adversity, it is proper to judge with indulgence. Many whose lot has been smooth and easy, like tempers which have never been tried, enjoy a favour and reputation which, in harsher circumstances, they would soon have forfeited; and he whose aberrations of conduct were few, when his virtue could produce no temporal advantage, may obtain credit for the superior rectitude he would have exhibited, had he been encouraged by a prospect of its usual rewards. Collins in his better days, does not seem to have exceeded the dissipation of his lettered associates; and the attic orgies, which were graced by the wisdom, and guarded by the virtue, of a Johnson, could be no matter of serious reproach. If the horrors of mind in which he was afterwards plunged, drove him to indulgences of a less venial description, the anguish of the disease may plead some pardon for the desperate remedy, by which he solicited its momentary abatement; and it is no slender praise, that for his practical errors he never sought theoretical apologies, but preserved the soundness of his principles, under the strongest temptations to quiet self reproof by relaxing them.

The genius of Collins may be classed among those of the higher order. Like Gray, he has left few productions, yet by these we may calculate the powers from which they proceeded, as by a small segment we can measure the dimensions of the whole circle. In the effusions of Collins we find every thing surveyed with the eye, and touched by the hand of a poet. He does not, like most of the polished versifiers who immediately preceded him, present elegant imitations of nature, under those aspects, in which she must appear to all observers. He views her through the prism of a glowing imagination, and transfers to her the colours which that faculty supplies. A common artist may be abundantly dextrous in his portrait of visible forms, but it is only a master, like Lorraine, who can enrich his landscape with hues which are drawn from his own ideal stores of beauty, which are characteristic of himself alone, and which stamp on his works the impression of original genius. Collins appears entitled to similar praise. Even in his Oriental Eclogues, though juvenile productions, which his maturer taste is said to have despised, the warmth of scenery which they display, and the tropical lassitude which they seem to breathe, shew the early vivacity of his conceptions; while his Odes excel in a peculiar richness of personification, and in the creations of a generative fancy, which impregnates all its objects with life and intellect. It must be acknowledged, indeed, that he sometimes carries his favourite style to excess, and continues to crowd the scene with visionary beings, or, in his own words, "with all the shadowy tribes of mind," till, by losing their distinctness, they lose their interest. His ideas, too, are occasionally so remote from that ordinary train of thought, to which the resources of ordinary language are, in some measure, limited, that while straining to express them, by means unequal to the end, he becomes at times unmusical and incorrect, and more frequently obscure. The best of his works are not entirely free from these faults. In the *Ode to the Passions*, which is perhaps the most popular of them all, we find the following offensive change from the singular pronoun, to the plural, in its singular use.

> " Why, goddess, why, to us denied,
> Lay'st thou thy antient lyre aside?
> As in that lov'd Athenian bower
> *You* learn'd an all commanding power,
> *Thy* mimic soul, O nymph endear'd," &c.

Our praise of Collins may, perhaps, appear extravagant, especially to those who adopt the fastidiousness of Johnson; but we appeal from this opinion, to the judgment of the public, already pronounced. A lofty place, in the temple of genius, can scarcely be denied to him, whose " gifted mind" had the power of producing compositions, so often read, rehearsed, and sung, as the *Odes to Evening; to the Passions;* and *to the Memory of those who died in* 1745. Nor should we forget the *Dirge in Cymbeline*, and the *Verses on the Death of Thomson*, which breathe the genuine spirit of sweetness, pathos, and simplicity. If a short fragment can preserve for Sappho a station among the higher rank of poets, we may offer these Odes as a standard to which the poetical energy of Collins was qualified to rise, notwithstanding his occasional inequality in its exertion. (w)

COLLINSONIA, a genus of plants of the class Diandria, and order Monogynia. See BOTANY, p. 90.

COLLISION. See MECHANICS.

COLMAR, a town of France, and the capital of the department of the upper Rhine, is situated at the junction of the Fecht and the rivulet Lauch, about half a league from their confluence with the Ill. The town stands on a fine plain near the foot of a mountain, and is reckoned one of the most agreeable and healthy places in the country. Colmar is surrounded with a wall, flanked with towers, and its streets are kept remarkably clean, by a number of small canals from the Fecht and the Lauch. It carries on a considerable trade in corn; and the wines of the adjacent country are exported in considerable quantities. At a little distance from the town there is a powder mill, and there are manufactures of woollen cloths, calico prints, stockings, hardware, &c. Population 13,396. East Long. 7° 22′ 11″, North Lat. 48° 4′ 44″. (*w*)

COLOGNE, the *Colonia Agrippina* of the ancients, is a town of France, and capital of the department of the Roer, is situated on the left bank of the Rhine, and is of a semicircular form, having its concavity towards the river. In 1187, Philip, archbishop of Heinsberg, took down the old walls of Cologne, and built those with which it is at present surrounded. These walls, which are now in a ruinous state, have 83 towers with conical roofs, 13 principal gates, and a circumference of 10,326 yards, or nearly 6 miles.

The streets, which are all paved with basalt, are narrow, winding, and gloomy, particularly those near the Rhine, which are crowded together for the purposes of commerce. The houses are very high, old, and ruinous, and form a singular mixture of all stiles of building during the last 1000 years. There is now, however, a very considerable number of modern houses. The materials for building are very expensive, being brought from a considerable distance, and the Dutch stile generally prevails.

The principal squares at Cologne, are the old market, the hay market, and the new market. The last of these is very extensive, and contains a beautiful promenade under a double row of lime trees. The chief streets, are the *Rue Large*, the *Rue St Jean*, the *Rue des Apostres*, the *Rue de Sexenhauser*, the *Trankgass*, and the large street, which extends from the gate of St Severin to that of Eichelstein.

One of the principal edifices in Cologne is the cathedral church of St Peter's, which was begun in 1248, by the elector Conrad, but remains still an unfinished ruin. Had the design been carried into execution, it would have formed one of the finest and most stupendous Gothic edifices in Europe, and even as it stands at present, overgrown with grass, and mouldering away with age, it presents a spectacle of unexampled sublimity. In the original plan, the two towers were each to have been 500 feet in height; one of them is only raised 21 feet above the foundation, and the other is no higher than 150 feet, and upon the top is still to be seen the crane by which the stones were raised. The body of the cathedral is very large. It is divided by four ranges of columns, amounting to 100, and the four middle ones are no less than forty feet in circumference. Behind the principal altar, which has a most imposing effect, is the chapel of the three kings, which the elector Maximilian built of marble. It contains the bodies of the three kings, and of the martyrs Felix, Nabor, and Gregory of Spoletto. In the year 1789, before the French revolution, the tombs were adorned with diamonds, and precious stones of all kinds, and 226 pieces of antiquity, and was reckoned the most superb and rich monument in Europe; but we fear, from the silence of recent travellers, that these spoils have been carried to Paris. A full account, however, of the tombs, and of all their ornaments, is preserved in a work entitled *Collection des pierres antiques dont la caisse des saints trois Rois Mages est enrichie dans l'eglise metropolitaine a Cologne, gravées apres leur empreintes, avec un discours historique analogue*, par. J. P. M. N. Bonn, 1781. The cathedral was used as a granary in 1800.

Next to the cathedral in importance and antiquity is the chapter of the ladies of *St Marie au Capitole*. The church is vast and well illuminated, and appears to have been built in the eighth century. The chapter of St Gereon is very rich and fine. The church, which was built in the eleventh century, has a vast cupola, and is reckoned the finest in Cologne. The chapter of St Ursula, which is filled with the bones of 11,000 virgins, is very ancient. In the choir of the church is a painting representing St Ursula arriving at Cologne, with a numerous attendance, in a large ship of war. The other chapters are those of St Severin, St Cunibert, of the Mere de Dieux à Staffeln, of St Andrew, of St George, of the Apostles, and of St Cecilia. At one time Cologne is said to have contained 260 churches and 37 convents.

The arsenal, which is used also as a kind of granary, is remarkable only for its size. It contains a great quantity of ancient arms, and is in a state of rapid decay. The theatre was built in 1783, but is far from being an elegant building. There are no fewer than twelve hospitals in Cologne, a society of emulation, a central school, a botanical garden, a physical cabinet, and a library in which are preserved the original letters of the Marshal de Turenne.

A large flying bridge serves as a communication between Cologne and Deutz on the right bank of the Rhine.

A very considerable trade is carried on in this city. It is the centre of all the commerce on the Rhine; it exports the wines of the Rhine and the Moselle, cast-iron goods of all kinds, timber for the purposes of ship-building, pottery goods, and slates. Its principal imports are coals from the adjacent countries, spiceries of all kinds, dry and salted fish, particularly herring, oils of every kind, and all sorts of woollen and silken stuffs. The principal manufactures of this town are cotton cloths, ribbands, paper, stockings, lace, and tobacco. About four leagues from Cologne, in the neighbourhood of Bruhl and Liblas, are mines of tuffa, known by the name of the brown earth of Cologne, which is used as a water colour by painters. It contains more vegetable than mineral matter, and probably has been produced by pieces of wood that have been long buried in the earth. The number of houses in Cologne is 7,404, and the population 38,844. East Long. 6° 55′ 15″, and North Lat. 50° 55′ 21″. A plan and elevation of the cathedral of Cologne, according to the original designs, and the most minute particulars respecting the history and antiquities of the town, will be found in the *Voyage sur le Rhin, depuis Mayence jusqu' a Dusseldorf,* tom ii. p. 88. Neuwied. 1791. (*)

COLONSAY. See HEBRIDES.

COLONY.

Definition.

COLONY (Latin *colonia,* Greek *ἀποικία*) signifies a body of settlers removed to a distance from their native country. In early ages, when agriculture formed almost the sole object of productive industry, a change of this description was accounted applicable to those only who might be induced to remove for the purpose of tillage. Hence the derivation of the Latin name *colonia* from *colo.* That name has passed into most European languages, although the more general and comprehensive term in Greek, would have been the fit appellation of modern settlements, many of which were formed with other views than those of agriculture. We shall proceed to treat at some length of the history of colonies, particularly those of modern times, and shall, for the sake of perspicuity, arrange the multiform details of the subject under specific heads.

Ancient colonies.

Ancient Colonies.—The earliest colonies of which the history is authenticated, were those of Greece. They owed their origin, neither to schemes of conquest, nor to speculations of commerce, but to the plain and direct conviction of the impracticability of subsisting in the territory of the mother country. Though Greece, in her best days, had by no means a population beyond the resources of her soil when tolerably cultivated, the art of tillage was, in the early ages, so rude and unproductive, as to impress the inhabitants with the belief, that the alternative of expatriation was indispensible. Of the manner of conducting those early emigrations, we have no regular accounts; they are known chiefly by the rapid progress which the settlements had made at the beginning of the ascertained period of Grecian history. By this time colonies of Dorians had been long established in Italy and Sicily; while those of the Ionians and Æolians had occupied the Islands of the Ægean Sea and the maritime part of Asia Minor. It was in these distant settlements that the early philosophers, poets, and political sages of Greece made their appearance. So quick an advance in improvement affords a remarkable example of a truth to which we shall presently advert—the striking advantages of a colonial establishment in facilitating the progress of arts and sciences. In the case of the Greeks, these advantages were not counteracted by any assumption of controul on the part of the parent state. An amicable intercourse was kept up between the kindred tribes, but the colony was neither involved in the wars of the mother country, nor restricted from making her separate interest the object of all her political arrangements. The formation of these colonies arose, as in the case of our American settlements, less from the act of governments, than from the enterprize of individuals. This circumstance, joined to a distance, which, small as it was, formed, in the infancy of navigation, a serious obstacle to the maintenance of intimacy of connection, rendered the colonies almost always independent of the mother country. When Cyrus overran the Lydian territory, the parent states in Greece declined to take arms in defence of their kindred tribes along the coast of Asia Minor. The latter were accordingly incorporated with the Persian monarchy, and remained subject to it, until the overthrow of Xerxes, and the naval triumphs of Cimon, enabled the Greeks to demand the acknowledgment of their independence, as a condition of suspending hostilities. During the preceding æra of Grecian glory, the colonies resumed, or rather formed for the first time, an alliance with Athens, the chief maritime power of the mother country, and contributed an annual sum as a fund for the general defence against Persia. This alliance continued till the latter part of the Peloponnesian war. The most important point in it for our present consideration, is the fact that the alliance in question comprehended, not merely the settlements of Athens, but those of her rival states, and was posterior, by several centuries, to the original emigration. It arose, therefore, less from the recollections of early connection, than from the dictates of present policy.

The Roman colonies were, in several respects, different from those of Greece. After the abrogation, in the third century of Rome, of the laws which stipulated the division of the conquered lands among the military citizens, the middling classes among the Romans were frequently losers even by successful war. Their limited portions of property were often neglected during their absence in the field, while their richer neighbours were enabled to carry on an uninterrupted cultivation by the labour of slaves. Hence the embarrassed circumstances and immense debts of the plebeians, by whom we are to understand, not the vulgar, but the middling classes in Rome. Hence those reiterated discontents, and the frequent clamour for the enactment of an Agrarian law. After many struggles, a law was at last passed to prohibit the possession of more than five hundred jugera, (three hundred and fifty English acres) by any individual; but the execution of this law was found impracticable, and from the influence of the rich over the poor, an attempt on the part of a spirited citizen to enforce it, seldom failed to lead to his downfall.* The usual salvo, on occasions of serious discontent, was an offer by the patricians to lead forth a new colony, that was to divide a remote portion of lately conquered land among a specified number of needy citizens. These settled on the allotted spot for the purpose (agreeably to the name *colonia*) of cultivating it; but the military policy of Rome made these detached portions of the community subservient likewise to other objects. The transplanted citizens were soldiers, and formed a strong out-post for the defence of the territories between them and the parent city. This system of colonization, exercised at first on a small scale, and directed chiefly against those troublesome neighbours of Rome, the Æqui and Volsci, was progressively extended, and continued even after the fall of Roman liberty. Among other colonies, it is on record that Julius Cæsar led one to Carthage. No fewer than 164 colonies were successively established within the limits of Italy, in the period between the foundation of the city and the death of the Emperor Augustus.

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* Brodie's *History of the Roman Government,* passim.

It does not appear, that any of the Roman colonies gave evidence of a progress remarkably superior to that of old settled states. This inferiority to the Grecian settlements, may be ascribed, partly to the almost exclusive attention of the parent state to military affairs, and more perhaps to the circumstance of the Roman establishments taking place in districts already occupied and cultivated. The new settlers were consequently incorporated with the mass of former inhabitants, and were more likely to imbibe their manners than to succeed in introducing those habits of economy and exertion, which, in general, are characteristic of emigrating citizens. The Roman colonies have some resemblance to the Indian settlements of modern Europeans. The native population predominating greatly over the new comers, the latter are to be considered in the light of a garrison to an out-post, maintained for the benefit of the mother country.

Carthage, approaching in her policy, much more than any other ancient state, to the habits of the maritime powers of modern times, we are enabled to trace a correspondent resemblance in her colonies. There is no reason to assign their origin to scarcity of subsistence at home, since the fleets and treasures of Carthage could, without difficulty, import an abundant supply of corn. Her colonies, therefore, seem to have been military stations, chosen for the purpose of commanding tribute, or appropriating the commerce of a particular district. The two mercantile treaties between Carthage and Rome, preserved by Polybius, imply an earlier attention on the part of the Romans to maritime affairs, than is commonly imagined. On the part of the Carthaginians, these curious documents discover a mercantile jealousy, which strongly reminds us of the prevalence of the same feelings in our own days.

Modern colonies.

Modern Colonies.—The Gothic ages, unfavourable to every kind of improvement, have nothing to boast of in respect to colonies. The crusades, though conducive, in several respects, to the removal of European barbarism, appear to have led to few useful establishments of the kind which we are now discussing. We meet accordingly with no examples of colonization, sufficiently general to mark an æra in history, until the comparatively recent discoveries of America, and of a passage to India by the Cape of Good Hope. It is fully three centuries since the progressive extension of the labours of the leading navigators opened the East and West to the enterprise of colonists from Spain and Portugal. India, the imagined depot of incalculable wealth, was the common object of the voyagers of either country. Columbus, sufficiently instructed, even in that illiterate age, to be convinced of the spherical form of the earth, calculated that the longer the distance to India was by an eastward course, the shorter it would be by the west. This argument formed the ground-work of his various applications to maritime powers for the equipment of a suitable squadron; and, in defence of any miscalculation on his part, it is proper to state, that the distance of India to the east had been magnified, beyond all bounds, by the reports of travellers. It was in consequence of India being uppermost in the thoughts of Columbus and other navigators, that the name of *West Indies*, or, as the French call them the *Little Indies*, was given to the Windward and Leeward Islands; and the appellation of Indians, bestowed, in the most comprehensive sense, on the savage aborigines of the immense continent of America.

The boldness and perseverance of Columbus, have, in connection with the selfish conduct of the court of Spain, after the death of his royal patroness Isabella, procured for him a large share of public sympathy, and have made the politic part of his proceedings attract a smaller portion of attention. He displayed, however, all the thoughtfulness of an Italian, along with that activity and power of rendering circumstances subservient to his plans, which characterise the authors of great enterprises. He continued to give the name of India to his discoveries, after it became perfectly clear that the two countries had nothing in common; and he made, in a public procession, a splendid parade of the gold and the products imported from these new regions. By way of interesting the Spanish government in the labour of the mines, he proposed, that no less than half the metallic treasures found in them should belong to the crown. This proportion was soon found exorbitant, and progressively reduced to a third, a fifth, a tenth, and eventually to a twentieth. The precious metals were long the sole object of attraction to the emigrants from Spain; to settle in their new territories with a view to cultivation, being for many ages foreign to their thoughts. The Portuguese, likewise, pursued mineral and metallic treasures in India, and the difference of conduct in the two nations, proceeded less from a diversity in their plans or intentions, than in the power and civilization of the countries which they respectively invaded. Mexico and Peru, defended by a feeble and unskilful race, offered little resistance to bands of enterprising adventurers; while India and her islands possessed sufficient population to call forth all the courage and exertion of the Portuguese commanders.

The motives which led to the establishment of the Spanish and Portuguese colonies, were thus considerably different from those which actuated the Greeks and Romans. There was here no complaint of deficient subsistence at home; no necessity to separate one portion of the population to serve as an outpost to the rest. In the case of India, the hope of a lucrative traffic; in that of America, the expectation of valuable mines supplied the decisive impulse to emigration. Nearly a century elapsed before either Spain or Portugal encountered serious opposition in their new territories. Portugal, in consequence of the encouragement of navigation by the government, and Spain by the absorption of so many maritime provinces under the sovereignty of Charles V. and Philip II., had taken decidedly a lead in the naval affairs in Europe. France, torn by internal dissension, and better fitted by situation for inland than foreign commerce, was no formidable competitor; and England was only beginning to feel her own strength. At last, the long continuance of good government under Queen Elizabeth, and the discomfiture of the Spanish armada, opened to our countrymen the prospect, not merely of annoying the Spaniards in the western hemisphere, but of appropriating a portion of these regions in permanent occupancy. Still the schemes of the intended colonists were directed much more to the search of gold and silver, than to the cultivation of the soil. It was very generally believed, that there existed, in unknown parts of America, veins of gold and silver, as abundant as those of copper or iron in Europe. Hence credit was given to the tales which led Gonzalo, Pizarro, Orellano, and others from Peru to the inhospitable tracks along the river Amazons; hence, likewise, the avidity in this country to believe Sir Walter Raleigh's fiction of the kingdom of El Dorado, and of a chief, whose throne was made of solid gold. These deceptions were propagated and continued, years after years, from a solicitude, on the part of the oppressed Americans, to send forward their troublesome visitors to a distant region. (Southey's *Brazil*, vol. i.) Accordingly, it was not until the seventeenth century, that our countrymen began to settle as cultivators, either in the West Indies or North America. To the Dutch, an opportunity of aggression on the Portuguese settlements in the East and West was opened, by the assumption of the crown of Portugal by their mortal enemy, Philip II. That step gave rise to long continued warfare in Brazil, and to a series of exploits in the Indian seas, which laid the foundation of very extensive conquests.

We shall now proceed to treat, in succession, of the several colonial settlements of European powers, observing, in the outset, that the working of mines has not been prosecuted in any other settlements than those of Spain and Portugal. That the want of those dazzling attractions is very far from being a disadvantage, will be sufficiently apparent, when we come to treat, in the sequel of our work, of the nature of mines. Human industry cannot be applied to a more precarious pursuit; and it is a well known fact, that, poorly cultivated as are Brazil, Mexico, and Peru, there is infinitely more comfort among the inhabitants of the agricultural than of the mining districts of these countries.

Spanish colonies.

Spanish Colonies.—The history of the transatlantic possessions of Spain, affords a most striking example of the evils of monopoly. All European nations have erred in this respect, and have injured themselves accordingly; but the sum total of their trespasses is trifling when put in comparison with those of the Spanish government. To put colonial trade into the hands of an exclusive company, is to create a body of which the interest is in direct opposition to that of the colony. Instead of favouring the progressive advance of consumption and production, the object of the company is to make sure, by a very plain process, of their personal profit at the expence of both. Abroad, the company's profit is obtained by limiting the supplies exported from the mother country; at home, by limiting the imports from the colony. The Spanish government was wholly ignorant of the principles of trade, and wonderfully jealous of the entrance of foreigners into their transatlantic possessions. It continued, until very lately, under the delusion, that the grand advantage of Mexico and Peru consisted in their mines, and that no pains should be spared to prohibit the access of such individuals as were not employed by government, to these mysterious deposits. It was determined, therefore, to confine the American trade to a single harbour, and, during several ages, Seville was the favoured port. It was not till 1720, two centuries after the occupation of America, that the privilege of colonial trade was extended to Cadiz. Even then, no person was allowed to ship an article of goods for Spanish America without a licence from the exclusive managers of the trade. These managers conducted their affairs with all the confidence and supineness of men assured of an uninterrupted possession of the colonial commerce. The vessels for Peru, Chili, and Terra Firma, were called galleons, and sailed only once a year. Mexico and the northern provinces were supplied by what was called the flota, which sailed in a collective shape only once in three years. No foreigner, and even no Spaniard, embarked on board these vessels without the permission of government; and, in the passage, the fleets were prohibited from touching at any intermediary port. But this was not all; the American colonies were strictly interdicted from holding a commercial communication with each other. Caraccas, for example, could receive no supplies from the neighbouring island of Trinidad, nor could Mexico relieve its wants by an application to the southern colonies. In short, the merchants were prevented from transacting business except at prescribed seasons, and at a few specified seaports. These were for the continent, Carthagena, with the unhealthy towns of Porto Bello, and Vera Cruz; in Cuba, the less exceptionable station of the Havanna, which, from the excellence of its harbour, and its central position, was the appointed rendezvous of all homeward bound fleets. Under such a system, we need not wonder that Robertson's *History of America*, cautiously and temperately as it is written, was not permitted to obtain circulation in Spain. The Royal Academy of History, at Madrid, unanimously elected him one of their members in 1777, in testimony of their approbation of his work, and appointed a gentleman to translate it into Spanish; but after considerable progress had been made in the translation, the Spanish government, dreading the publication of a work which so fully explained the nature of the trade with America, and the system of colonial administration, interposed its authority to stop the undertaking. See Mr Stewart's *Life of Dr Robertson*.

The consequence of cramping, in such a manner, the intercourse between the mother country and the colonies, was an exorbitant enhancement of the articles exported, it being common to charge in America double, and sometimes triple, the European price. That intelligent traveller, Ulloa, relates, that he has seen a pound of iron currently sold in Peru at four shillings and sixpence, and the pound of steel for six shillings and ninepence sterling. Such a state of things could not fail to lead to smuggling. Accordingly, all the exertion, the expenditure, and the rigour shewn, age after age, by the Spanish government, were ineffectual in preventing the existence of a clandestine intercourse of great extent. One penal law was added to another, and even spiritual punishment, the most formidable of all punishments to a Spaniard, was threatened; but the wants of the colonists, and the vast extent of accessible coast, had the effect of counteracting all impediments. It was a singular circumstance, that the English contraband traders in Jamaica were supposed to enjoy as much of the Spanish colonial trade as the mother country herself; and the consequence was a progressive diminution of the regular shipments from the latter, until at last they threatened to fall off altogether.

The mortifying evidence of experience led ultimately to a gradual modification of this absurd monopoly. In 1740, the Spanish government consented to the use of "register ships," which may be defined "separate equipments, unconnected with the periodical fleets, and less limited in regard to freedom of intercourse with the colonial seaports." This, however, produced hardly any other good effect than an increased frequency of exportation, for a heavy tax was exacted by government on the register cargoes, as well in the shape of license as of duty. It was not till 1764 that regular packets were established between the colonies and the mother country. These packets sailed from Corunna, and were allowed to carry both out and home limited investments of merchandise. Next year, a more important step was taken, the intercourse with the Spanish West India islands being laid open to the principal ports of Spain. A few years after, a similar permission was granted in regard to Louisiana, Yucatan, and Campeachy. But it was withheld till 1778 from the richer colonies of Peru, Chili, Buenos Ayres, Santa Fé, and Guatimala. Last of all came Mexico, which, partly from its superior importance in respect of mines, partly perhaps from an apprehension of internal dissatisfaction, was not opened to the principal ports of the mother country until 1788. The ports thus licensed to trade with America, were,

Alicant and Carthagena for Valentia and Murcia,
Corunna for Galicia,
Gijon for the Asturias,
St Andero for Castile,
Barcelona for Catalonia and Arragon,
Cadiz and Seville for Andalusia.

The limitation of the trade to these particular seaports, arose from a view partly to facilitate the collection of duties, and partly to preserve a superintendence over the persons embarking for the western hemisphere. It deserves to be recorded as a memorable proof of narrow policy, that the permission to the Spanish American provinces to carry on a free trade with *each other*, was not granted till 1774. So discouraging to the first active powers of the colonies, was this system of extreme monopoly, that the Spaniards, who are great consumers of cocoa, and who possessed in America the finest soil and climate for its growth in the world, were actually obliged to make importations of it from other countries. The island of Cuba, the most fertile perhaps of any in the American Archipelago, did not, in 1765, employ twenty vessels, but within twelve years after the abrogation of the monopoly, it employed two hundred. Even the city of Cadiz, which clamoured most loudly against the opening of the trade, reaped most important advantages from the change. It continued the emporium of colonial intercourse, and found its proportion advance in the same favourable ratio as the trade of the kingdom at large. Cadiz is to Spanish America what London is to the British settlements; more than half of the colonial trade being conducted respectively in each of these ports.

No country in Europe was less fitted to derive advantage from a large track of colonial possessions than Spain. The indolence of her inhabitants, the bigotry and ignorance of her government, have had the effect of perpetually keeping her bare of capital; and so far from being able to spare funds for transatlantic cultivation, she was destitute of the stock requisite to do justice to her own provinces. Hence one great cause of the miserable progress of her colonies, though possessed of natural advantages that excited the envy of the world. For such a government, and such a people, it was perfectly natural to confine their exertions to the working of mines, and to overlook the incalculable treasures which would have rewarded the labour of the agriculturist. The progress of the Spanish settlements accordingly has been great in population only, the natural and direct consequence of an overflowing stock of provisions. It was, until lately, a very prevalent notion, that Spain and Portugal had suffered, both in population and in capital, by their colonies. Those who contrasted the extensive influence of Philip II. in the affairs of Europe with the insignificant figure made by the subsequent possessors of his throne, did not hesitate to account for the difference by the exhaustion consequent on the transfer of subjects and of capital to the western hemisphere. It is now, however, ascertained, that Spain was never so populous as at present; that in the course of the last century she has nearly doubled her numbers; and that her fall in the scale of political power is to be ascribed, not to retrogradation on her part, but to a more rapid advance on that of her northern neighbours. These considerations are correctly, though we admit very diffusely, illustrated by M. Laborde in his voluminous account of that kingdom. A similar course of reasoning, as far at least as regards the colonies, is followed, (Vol. I. p. 396. et seq.) by Mr Brougham in his *Colonial Policy*.

In regard to population, the Spanish colonies differ both from the United States and the West India Islands. The disproportion of whites is smaller than in the latter, while, on the other hand, their number in no degree approximates to that of the former. The immense field open to agricultural labour would have the effect of giving a general character of steadiness to the inhabitants, were not the lottery of mining perpetually holding forth a temptation to depart from the gradual, and, in the eye of an ardent calculator, tardy progress of agriculture. In their sanguine anticipations, the insecurity inseparable from mining concerns is greatly under-rated, while the progressive, but eventually large returns of agriculture are accounted of little weight in the scale. The fact, however, is, that the advance of agriculture is not only more sure, but frequently more rapid than that of commercial settlements; and the reason is plain, the market of the former exists chiefly among themselves, while that of the latter is dependant on the caprice of foreign nations.

The island of Cuba has, during the present age, made more rapid advances than any other part of Spanish America. The number of its negroes in 1787 exceeded 50,000, and they have been since in a state of progressive increase. There being no restriction on the mode of manufacturing sugar, it is common to clay it before exportation, and as it thus becomes of greater value by twenty per. cent, a proportional saving is made in regard to freight. The sugar is packed in boxes weighing generally 4 cwt. 1 quarter English, and the annual crop is computed (*War in Disguise*, 3d. edition, p. 230) at eighty or ninety thousand hogsheads.

Portuguese colonies.

Portuguese Colonies.—The Portuguese have certainly ranked next to the Spaniards, in the art of mismanaging colonies. They did not, indeed, for a long time, commit the error of establishing an exclusive company for their splendid acquisitions in the East; but they did what was fully as impolitic, they vested the trade in the hands of the executive government. The king granted from time to time the permission of making exports and imports to certain partnerships and individuals, who thus enjoyed temporary monopolies. This hopeful course was, in a great measure, abandoned in the year 1752; but the change, as to the India trade at least, came too late, that branch of commerce being no longer worth following. Brazil becoming progressively more populous, would have afforded a beneficial commerce to Portugal, had the intercourse not been conducted in the true spirit of exclusion and monopoly. Unfortunately about a century ago, at the time when better principles might have been brought into operation, discoveries were made of gold and diamond mines. These discoveries were pernicious to Brazil in two ways; they turned capital from agriculture to the precarious, and, in general, unprofitable labour of mines, while they redoubled the vigilance of government in regard to restraints on the communication with the colony. A late traveller, Mr Mawe, whose report, if deficient in literary attractions, possesses the merit of much clearness and candour as to matters of fact, confirms most explicitly the opinion, that the condition of the inhabitants is much more uncomfortable in the mining than in the agricultural districts. By a singular absurdity, the Portuguese ministry resorted, in the middle of the last century, to the plan of an exclusive company for Brazil, after the rest of Europe began to see the folly of these privileged associations. This took place during the administration of the well-known Marquis de Pombal. A long course of misgovernment has thus retarded the improvement of Brazil, and the chief part of it continues at the present day in a state of nature. The Prince Regent's estate, for example, though nearly equal in size to one of our counties, and highly favoured, both in soil and climate, is not sufficiently cultivated to support two thousand persons. How greatly the mercantile importance of Brazil has been overrated by our traders, has been sufficiently apparent, from the long lists of bankruptcies originating from shipments made to that quarter. Our exporters allowed themselves to imagine that Brazil was already peopled by a nation qualified to use and enabled to pay for immense supplies of British manufacture. Now the true way to appreciate Brazil, is to direct our estimates to its future capabilities, and to postpone our expectations of extended trade, until the lapse of another age has given it a new character. But, considered relatively to the smallness of the mother country, Brazil, even in its present state, becomes an object of importance. It is said (Brougham's *Colonial Policy*, Vol. I. p. 485.) to supply a fourth of the national revenue, and to furnish to the harbours of Portugal as much import trade as they receive from all Europe together. The power, likewise, of admitting or excluding the maritime nations of Europe from the ports of Brazil, tends materially to increase the political influence of Portugal.

British colonies.

British Colonies.—Though our maritime enterprizes against the Spaniards, and our projected settlements in Guiana, were prompted by the hope of golden treasure, the case was very different in regard to North America. A desire to exercise in freedom the profession of their religion, was a powerful motive of emigration with the early colonists; and in the middle of the seventeenth century, our civil wars supplied a new motive for seeking a foreign asylum. As the country became cleared, and as the reports of acquired fortune, always exaggerated at a distance, prevailed among the home connections of the settlers, fresh adventurers were induced to undertake the passage across the Atlantic. Though the English, nationally speaking, are not fond of emigration, the maritime habits of a proportion of the people, and the idea that a boundless field was open to the exertions of enterprise and industry in this unexplored hemisphere, proved the means of contributing successive additions to the number of the colonists. The main source, however, of increasing numbers, was the practicability, from abundance of provisions, of early marriage. All these causes concurred to raise the population, by the middle of the 18th century, to more than two millions, a number which, though not one-fourth of the present stock, was greatly beyond any calculation likely to be suggested in a former age, by the appearance of a wooded, and at first unhealthy region. It deserves also to be remarked, that the religious disposition of the original settlers, and the serious habits impressed on their descendants by the necessity of continued labour in retired situations, have given the Americans, particularly those of the northern and middle states, a character of more devotion than is generally found among European nations.

In the case of our colonies, a progressive advance to prosperity was not retarded by the unfortunate circumstances attendant on those of Spain. There were here no metallic treasures to excite the cupidity of government, and the settlers being poor, enjoyed, in considerable latitude, the benefit of the political maxim, *laissez nous faire*. Though prevented, in a great measure, from trading with any other country than Great Britain, they were limited to no particular harbours, so that the restriction, in the early part of their career particularly, was not productive of material detriment. Another point, and a most essential one, was that of exemption from taxes; the mother country taking on herself the charge of military protection, not indeed from motives of generosity, but from a conviction of the inutility of attempting to collect any considerable revenue from a thinly scattered population. The colonies in consequence have no financial burden but that of their civil government, which, as they had neither king nor nobles, was abundantly moderate. But while it is admitted that the natural advantages of colonial settlements were less counteracted by illiberal regulations of the parent state in our case than in that of other countries, our acts of parliament on this subject will, at the same time, be found to afford a curious exemplification of the effects of the mercantile system. The produce of our North American and West India settlements was divided into two distinct classes—"enumerated" and "non-enumerated" commodities. The former were exportable to the mother country only; the latter might be sent to any part of the world, if shipped in a British vessel. On analyzing the motives of this important distinction, we find, not the benefit of the colonies, but the imagined benefit of the mother country, the prevailing object with our legislature. Corn was a "non-enumerated" commodity; and as it formed the leading article of produce in our northern colonies, the permission of its free exportation might have been ascribed to parental solicitude for the welfare of our American relatives, had it not been accompanied by a law prohibiting its import into *Great Britain*, the market which of all others would have been most desired by our colonists. Here was a notable example of that unfortunate prejudice which still actuates our landed interest, and makes them consider an enhancement of money not as equivalent to an increase of income. A parallel instance was afforded in the case of the cattle of our colonies. The exportation of them, either alive, or in the shape of salt provisions, was permitted to all parts of the world *except the mother country*. Next, as to the "enumerated commodities," our rule was to compel the importation into Great Britain, exclusively, of sugar, coffee, tobacco, cotton, indigo; in short, of whatever could not interfere with the growth of our own soil and climate. We calculated on thus having a supply for all our own wants in the first instance; and, in the next, a profit on all that we should sell to other nations.

So long as our consumption was proportioned to the growth of the colonies, the positive obligation to ship every thing to Britain was not productive of serious injury to our fellow subjects abroad. In the time of Dr Smith, our growth and consumption corresponded sufficiently to each other; a consideration to which, as well as to the very delicate predicament in which we then stood with our American provinces, we are to ascribe the palliating tone in which a writer, otherwise so independent, thinks proper to speak of the course of our policy towards our colonies. Enough has happened in our own day to give evidence of the injurious effect of forcing our West India settlements to throw all their produce into one market. Since the year 1799, the amount of their sugar crops, partly from extended cultivation, but more from the conquest of foreign settlements, have greatly exceeded our means of consumption. The planter has accordingly been repeatedly forced to send home his produce without obtaining any profit whatever. No consideration of sympathy towards these our unfortunate countrymen was sufficient to overcome the inveteracy of long established prejudice. Our ministers were prevented, by apprehension of clamour, from making any relaxation in the provisions of the law; and the landed interest, instigated apparently by selfish individuals, acted a part wholly unsuitable to their general character. On two occasions, in 1808 and 1811, they mustered all their parliamentary strength to prevent the substitution of sugar for corn in the distillery, although examples of the sufferings of the poor from deficiency of provision were fresh in their recollection.

Another class of "enumerated" commodities was composed, not of the produce of a tropical climate, but of articles of northern growth, such as naval stores, ship-timber, iron, copper, &c. Of these, likewise, we compelled the importation into Britain exclusively, in consideration of the inadequacy of our own growth for our consumption, and of the advantage of increasing our mercantile navy, by confining to British ships the carriage of articles which might otherwise be brought to us in the vessels of foreign countries. In one point, however, our colonies enjoyed unlimited freedom—we mean an intercourse with each other. No restraint was imposed on the navigation from North America to the West India islands, or *vice versâ*, so long as the former continued a part of our empire. From the spirit that dictated these various acts of the legislature, it is clear, that while we were always willing to fight for our colonies, and, with our characteristic promptitude in pecuniary contribution, had no objection to bear the chief part of the burden, we never lost sight of the prospect of a beneficial return in the shape of trade. We calculated, and, as we thought, with unerring policy, that the true plan was to keep the trade almost entirely within ourselves. Hence our resolute adherence to the rule of excluding other nations; hence also our obstinate prosecution of the war to bring back the Americans to a state of dependence. We had yet to learn that they might become more profitable to us in a separate and independent situation; a point which shall be forthwith illustrated in the concluding part. See the *General Observations on Colonies*, p. 756.

We shall next present our readers with several Statistical Tables relative to our West India colonies.

I. *Population of the British West India Islands in 1805, taken from Bryan Edwards' History, and from Returns to the House of Commons.*

Islands.	White People.	People of Colour.	Slaves.
Jamaica	28 000	9000	280,000
Barbadoes	15,000	2130	60 000
Antigua	3.000	1300	36.000
St Christopher's . .	1 800	1[illegible]8	26 000
Nevis	1,300	150	8,000
Montserrat	1 000	250	9,500
Tortola, &c.	1 300	220	9,000
Grenada	1,100	800	20 000
Dominica	1,594	2822	22 083
St Vincent's	1,600	450	16 500
Tobago	900	700	14,883
Trinidad	2.261	3275	19 709
Total	58.955	21,967	524,205

In Trinidad the number of coloured people has increased greatly of late years.

II. *Proportion of Sugar to the Land and Labour employed in its Cultivation in our respective Colonies.*

In Jamaica, it is computed that, on an average, one-half hogshead sugar is raised per acre; two-thirds per negro.

Dominica, the same.

Grenada, three-fourths hogsh. per negro and per acre.

Antigua, one-third hogsh. per acre, and one-half per negro.

St Kitt's, one hogsh. per acre; one-half per negro.

St Vincent's, one hogs. and one-fourth per acre and per negro.

Tobago, one hogsh. per acre and per negro.

III. *Imports of Slaves to British West Indies, on a Medium of two Years,* 1802 *and* 1803, *from Official Returns made to Parliament.*

Islands.	Imports.	Exports.	Retained.
Jamaica	7662	2402	5260
Barbadoes	1050	28	1022
Antigua	434	100	334
St Christopher's . . .	971	124	847
Nevis, &c.	238	. . .	238
Tortola	438	259	179
Dominica	550	34	516
Grenada	1097	2	1095
St Vincent's	1540	. . .	1540
Tobago	172	. . .	172
Bahamas	2523	2230	297
Trinidad	4516	33	4483
Demarara and Surinam	7164	. . .	7164
Total slave trade	28.355	5212	23,137

The most remarkable feature in this outline is the extraordinary number of negroes imported into the Dutch colonies. The slaves exported from the Bahamas went partly to Cuba; partly to the United States.

IV. *Sugar Produce of Jamaica compared with the Produce of the rest of the British West Indies, agreeably to Return to the House of Commons, May 6th* 1806.

In Hogsheads of 13 Cwt. of 112 lb. each.			
Years.	Jamaica.	Other Islands.	Total Sugar.
1793	80,300	83,200	163,500
1794	89 800	73,500	163,300
1795	83,200	45,100	128,300
1796	83,400	47,800	131,200
1797	80,030	41,044	121,074
1798	83,350	67,350	150,700
1799	95.000	98,000	193,000
1800	110.500	67,530	177,830
1801	143,200	79,950	223,150
1802	144,100	117,350	261,450
1803	125,000	87.300	212,300
1804	120,000	109,000	239,000
1805	132,000	92,700	224,700

It appears from the above Table, that the average crop of Jamaica considerably exceeds that of all our smaller sugar islands together. This, however, is to be understood of the British settlements only; for were the crops of the Dutch and French colonies added to those of our Windward Islands, the annual average would considerably exceed that of Jamaica.

V. *Rum.*

Years.	Annually exported to the United States of America. Gallons.	To British North America. Gallons.	To Great Britain and Ireland. Gallons.
1793	536,353	613,898	3,756,800
1794	2,265,177	525,720	2,806,623
1795	2,106,883	204,965	1,861,886
1796	3,267,280	307.124	1,993,350
1797	2,197,450	486.706	1,595,008
1798	1,972,985	384,953	3,866,138
1799	3,201,209	664,258	2,404,982
1800	2,761,384	186,449	3,283,392
1801	3,638,021	569,691	3,940,859
1802	3,925,595	584,678	4,166,113
1803	4,198,154	792,474	3,790,868

We regret to add, that one of the unfortunate consequences of our Orders in Council, has been the loss of the market of the United States for our rum, the Americans having resorted to the alternative of making use of their own corn spirit.

VI. *Tonnage and size of Ships in the West India Trade in* 1804.

	Ships.	Tons.	Medium tons each.
London	326	104,312	324
Outports . . .	188	52,009	277
Scotland . . .	84	17,932	242
Ireland	47		

This statement, short as it is, suffices to shew, that although the ships of the outports make, from their number, an appearance nearly equal to those of the metropolis, the larger portion of the trade remains with the latter. The outport ships frequently make more voyages in an equal period; but, on the other hand, their cargoes are, in a considerable part, consigned to London houses, for whom the outport merchants act as factors.

Our next table is a comprehensive one, and affords the means of estimating the importance of the West India colonies, in regard both to revenue and to the amount of capital which is annually circulated through means of their produce.

VII. *Value of Imports from the West Indies, and the Revenue of which they were productive at the Prices of* 1804-5.

	Quantity.	Value.	Duty, Custom, and Excise.			Revenues.
		L.	*L.*	*s.*	*d.*	*L.*
Sugar, home consumpt—cwt. .	1,966,146	7,569,662	1	7	0	2,654,297
Exported	1,386,289	3,950,924				
Rum, home consumpt—gall. .	2,787.253	2,105,433	0	11	2½	1,563,679
Ditto, exported—gall.	1,059,269	202,243	0	0	3	13,241
Coffee, home consumpt—cwt. .	9,569	146.985	9	7	2	89,547
Ditto, exported—cwt.	193,445	1,165,520	0	0	6	4,863
Cotton—lb.	10,472,418	1,097,242	0	0	2	87,271
Miscellaneous articles		775,108				106,500
Total		17,002,117				4,519,398

VIII. *Value of Exports to British Sugar Colonies in* 1804.

British produce and manufacture	L. 5,124,210
Irish produce and manufacture	371,560
Foreign articles	250,583
Freight on the above computed	1,436,588
Mercantile commission, &c. 2½ per cent. gross	456,180
Insurance at 4 per cent. in gross	300,000
Convoy duty at 2 per cent.	114,920
	L. 8,054,041

It must not, however, be concluded, that the surplus of imports over exports, is a clear revenue derived to proprietors of West India estates resident in Great Britain. Custom-house tables take no account of the very large sums drawn from the mother-country in the shape of bills of exchange, which are paid away by the planters, partly to the Americans for stores, partly to mercantile residents in the colonies, for the various wants of the estates. The fact is, that, so far from affording a clear return, there has been a regular drain of British capital to the West Indies since the year 1799. When the cultivation of a property has once been undertaken, the planter has seldom any other alternative than that of carrying it on at all hazards. In a country so bare of capital as our sugar colonies, a solvent purchaser is not often to be found; and the creditor who has made an advance, must either submit to a heavy loss, or consent to an extension of his loans, with a view to render the land ultimately productive and valuable.

It has been attempted, at different times, to form an estimate of the total value of capital in the British West Indies. Such calculations are necessarily vague; but it is not unimportant to mention, that, from two different estimates, (Sir William Young's common-place book, p. 25.) the result appears about eighty millions sterling. This valuation is to be understood in a very comprehensive sense, as it comprises negroes, lands, buildings, cattle, dwellings, and even shipping. We conclude our tables on the subject of sugar produce with a minute of the importations for several years from the East Indies.

IX. East India sugars were expected, twenty years ago, to form a great article of importation; but it was soon discovered, that, from our settlements at least, they could not be afforded at so low a rate as the West India sugars. Accordingly, the supplies from that quarter have been comparatively insignificant.

	Hhds. of 13 cwt.
In 1801	4700
1802	4200
1803	5300
1804	8000
1805	4100

The insalubrity of our West India colonies, is a topic too serious and too important to be passed over; but we reserve our documents on this head till we come to make some general observations on the nature of colonies.

New South Wales.

New South Wales.—This article would be incomplete were we to omit noticing a colony of a peculiar kind formed in our own day. Though the experiment of transporting convicts has been found highly expensive, (the whole cost, from first to last, exceeding L. 300 a-head,) and though the practice, as a measure of punishment, is not likely to be continued, the settlement in New South Wales is, as a colony, an object of considerable interest. Its growth, in point of population particularly, has of late years been more rapid than was to be expected from the bad habits of the people, and the desert condition of the country on their first arrival. Imagination cannot conceive a tribe less likely to become useful and productive labourers, than the occupants of this settlement. Distance from home had by no means the effect of operating a reformation in their conduct. They had hardly arrived, when they were tempted to display their habits of knavery even on the poor and miserable natives. Some time after, a theatre being erected, the persons who ventured to resort to this amusement, generally found, on their return home, that their neighbours had made free with their property. It became necessary, in consequence, to destroy the theatre; and it was at the same time found indispensible to erect a stone prison, the wooden buildings of that description having been wilfully burned. A vice equally odious, and productive of more general mischief than the propensity to theft, was a rooted habit of intoxication. Whatever was the price of spirits, a price rising frequently to 20s. a bottle, these victims of depravity were found to expend their last pittance in this ruinous gratification. Such excesses were confined, indeed, to the convicts; but the high profit attending the spirit trade, had a bad effect likewise on the free settlers, many of them being tempted away from the pursuits of agriculture by the dazzling prospects of this noxious traffic.

Such was the state of the colony during its first years. In 1795, Governor Hunter entered on office, and was indefatigable in his efforts to reclaim the inhabitants, and improve the settlement. He continued governor during six years, and, at his departure, the number of colonists of all descriptions amounted to 6000. By this time the natives had become reconciled to their European neighbours. It was a matter of some consequence to suspend their acts of hostility, although their incurable indolence afforded no room to hope for their cooperation in useful labour. They seem to belong to the least promising class of barbarous tenants of the woods; and even in a state of peace, they have little scruple in plundering the corn of the settlers. In the midst of their misery, they ridicule the labour and precautions of Europeans; and, after a temporary residence in a civilized quarter, they are found to return with double relish to their original wildness. Their chief weapon is a spear, which they throw with great force, and with unerring aim, to a distance of more than one hundred and fifty feet. Next to the savages, the Irish convicts proved the most troublesome inmates in this new establishment. A detachment of them arrived in 1800, after the unfortunate rebellion, and were eager to disseminate their seditious feelings among the rest of the prisoners. The vigilance of the governor, however, prevented them from gaining ground, so as to disturb the tranquillity of the settlement.

The colony of Botany Bay differs from our other foreign settlements, in the material point of being a government undertaking. While in North America and the West Indies, each settlement has had to make its own way, and to find its chief resources within itself, the government in New South Wales was authorized to draw capital in large sums from the mother country. The consequence has been, a rapid progress in the formation of the colony, accompanied, however, with an extraordinary degree of expence. Part of that expence, indeed, was unavoidable, in consequence of the wretched habits of the colonists; but part, also, has been very unprofitably incurred. New establishments have been formed on distant points; and one of them, that of Norfolk Island, has been abandoned. Under such a system, we must not expect to find a favourable display of the virtues of industry and economy; nor are military or naval men (who have hitherto filled the station of governors) the fittest persons to give a beneficial direction to the labour of the prisoners. There is now, we understand, a disposition to put an end to farming for government account; a symptom which we hail as indicative of considerable amendments. Among grievances of a different nature, we mean the abuses calculated to excite sympathy and regret, one of the most striking is the want of humanity shewn to convicts on the passage out. This is strongly exemplified by the contrast between our ships of war and the contract ships employed to carry out these unfortunate people. The former have been known to perform the passage, long as it is, without almost any loss of lives, while the latter sometimes lose so large a proportion as a third of the number embarked. This is owing, in some degree, to excessive severity of treatment, but much more to a scandalous embezzlement of the provisions. Equal mismanagement has prevailed in regard to the clothing sent out from home. It has been made up, in the first instance, without sufficient regard to the nature of the climate; and, on arrival in the colony, it has been distributed at once, without attending to the necessity of dealing it out by piece-meal to the thoughtless creatures, who are impatient to sell whatever they do not require for present use.

The convicts, on arriving, are in general released from their irons, and ordered by the governor to work on some public undertaking. A proportion of them are successively removed from public work, to be employed in the country under the free settlers. The number of goverment labourers is farther diminished, as well by deaths as by emancipation for good behaviour, and by expiration of the term of servitude. Those who have been brought up to a mechanical profession, generally find it expedient to practise it here. The noted Barrington belonged to the number, unfortunately not large, of penitent sinners. His conduct latterly became exemplary, and he discharged the duty of chief constable with great propriety. To those convicts who persist in a course of depravity, no mode of punishment has greater terrors, than that of removal to a solitary branch of the settlement. The apprehension of separation from old connections, is, on such minds, of much more powerful operation than the prospect of bodily suffering. Repeated examples have occurred, of criminals returning to their iniquitous course, after a second and a third punishment of the latter description; and the case of one Samuels, (Mann's *New South Wales*, p. 12.) seems to imply, that, in certain individuals, a recurrence to guilty practices is unavoidable.

During several years after the first arrival, the colony was occasionally in danger of famine, from obstacles to the receipt of supplies from home. After progress had been made in clearing the neighbouring district, and the cattle brought over had begun to multiply, this apprehension of course disappeared. At present, the price of corn seems nearly the same as in this country, and the price of butcher meat not much higher. The chief enhancement is experienced in whatever requires manual dexterity and the use of implements. Butter, from the scarcity of dairy accommodations, is twice, or rather thrice, its price in this country. Some progress, however, has been made in manufactures, particularly in the tanning of leather. Malt liquor being an article in general demand, and difficult of importation, the colony contains already four extensive breweries. The total population now approaches 12,000, of whom about a third are victualled and clothed at the public expence, while the others find means to earn their own support. The free settlers, who embarked for so unpromising a region, were not likely to belong to a meritorious class of society, and many of them have accordingly proved a burden on government. No branch of trade is carried on with more activity than the sale of female dresses and ornaments. The avidity to purchase these, in this remote quarter, seems not inferior to the passion for dress in spheres of greater splendour; and the shops are already fitted up with a degree of taste beyond our ordinary ideas of Botany Bay.

We shall conclude our remarks on this colony, by a notice of the principal things which remain to be done for its amelioration. The first of these, recommended as it is both by policy and humanity, is the determination of some specific limit to the state of durance in the cases of transportation for life. Whatever may have been the guilt of these persons, an ultimate prospect of relief, at some time or other, should be allowed to visit their imagination. Without such a prospect, they must continue unprofitable servants to the public, as they must be almost wholly hopeless in regard to their future fate. Another point of some consequence, is the introduction of bankrupt laws. There cannot be a more mistaken humanity, than to prevent the concerns of an embarrassed man from being brought to a decisive termination; as it often happens, that he is induced to cling to a hopeless business, and to pass the best years of his life, without benefit either to himself or his creditors. A third improvement in this colony, would consist in the appointment of a civil governor, the questions of internal regulation becoming now too numerous for a military tribunal. A fourth object of attention, should be the nomination of a chief justice, who, whether he take law or equity as the rule of his decisions, should be a man of ascertained ability and experience. The colony supplies few persons fitted to act as justices of the peace; and not many, perhaps, qualified to discharge with impartiality the functions of a juror. Hence the necessity of a judge going out from Britain, and of a form of procedure sufficiently simple and expeditious, to enable him to transact the judicial business of the settlement, as well as to save to the colonists a great part of the ordinary expences of law.

Dutch colonies.

Dutch Colonies.—The settlements of the Dutch in America have not been proportioned to the greatness of their maritime means. After conquering, in the seventeenth century, a great part of Brazil, they found it impracticable to retain it against the will of its Portuguese population. In the north, their colony of Nova Belgia was conquered by us in the reign of Charles II. and became an English province under the name of New York. The cause of so lukewarm a disposition towards America on the part of the Dutch, in this their era of power and vigour, is to be sought in their predilection for their possessions in the East. These possessions embraced the Cape, Java, the spice islands, part of Ceylon, and several maritime stations on the continent of India. The commerce carried on between them and the mother country was very considerable, and passed, in the eyes of most men, for the pillar of the national wealth. In that age, the superiority, in productive power, of inland over foreign industry, was unknown. The notion, that home traffic is an unprofitable transfer from hand to hand, and that national gains are obtained only from abroad, was then still more general than at present. From the imposing magnitude of the India ships, and the long catalogue of Dutch stations and provinces, it was natural to infer, that an extraordinary amount of profit must arise from such a source. The writers of the last age went the length of pronouncing the Dutch possessions in the East much more valuable than the mother country: a notion a good deal similar to that of the French of the present day, who believe Bengal to be the main spring of British revenue. These considerations, partly well partly ill founded, had the practical effect of inducing the Dutch to keep up with great care their eastern acquisitions, while, in the West, they aimed at nothing beyond the small islands of St Eustatia and Curaçoa, along with a continental track in Guiana, which, in recent times, has owed much to British improvement, and has become familiar to us by the names of its subdivisions,—Surinam, Demarara, Essequibo, and Berbice.

As the Spaniards have been accounted the mildest of European taskmasters of negroes, the Dutch have been accused of falling into the opposite extreme. These contrasts, however, are generally exaggerated, and, on analysing the matter, we should probably find that the character attributed to the Spaniard arose from his being too indolent to keep his people at work, while the Dutchman, accustomed to labour himself, made a point that his servants should follow his example. The Dutch West India company was incorporated in 1621, a brilliant æra in the long struggle of the Hollanders for national independence. Spanish America, as well as Brasil, were open to the aggressive warfare of the Dutch, and their new company performed less the part of traders, than of directors of the naval exertions of their countrymen in the West. When political circumstances produced a cessation of the long contest with Spain, the unfitness of a great company for the management of concerns, merely commercial, was felt, and, in 1674, the association was dissolved. A second company was formed, but with no other monopoly than that of the African slave trade; and in 1734 the latter likewise was laid open, on condition of the traders paying certain dues to the company. The Surinam company was a kind of emanation from the larger association; the latter on obtaining, in 1682, certain privileges from the States General, for the supply and management of Surinam, admitted two new parties to the contract, in consideration of their sharing the expence of the charter. These parties were the city of Amsterdam, and the opulent family of Sommelsdyk. The business of the association was managed at Amsterdam by representatives from each of the parties, but all the vigilance and economy of Dutch directors were unable to form a counterpoise to the disadvantages inherent in mercantile coalitions. The stock of the company never rose to par, and fell eventually so low as thirty per cent. These examples of failure, on the part of the Dutch, are the more remarkable, because Holland was, of all countries, best fitted to supply the large advances required for newly settled countries. The interest of money in Holland, so far as 150 years ago, was very low, and did not, on undoubted security, exceed three per cent. while in England it was nearly double. The consequence has been, that while in this country no merchant has advanced capital to a colonist without obtaining a commission in addition to interest on his money, the Dutch capitalists have not hesitated to make loans on the security of West India plantations, for mere interest, in the same way as in London a banker subscribes to a government loan on the security of stock. The extent to which this kind of business was carried, affords a striking proof of the ease with which uncultivated regions might be rendered productive, if the fruits of industry were not wasted in war expences. Thirty years ago the capital due by the colony of Surinam to the mother country, amounted, says M. Malouet, to eight millions sterling. This sum, large as it was, bears a small proportion to the mass of additional debt incurred by the planters, since they came under our dominions seventeen years ago. The high price of sugar in 1797 and 1798, induced our merchants to make very improvident advances for the purchase of negroes, as well as for other purposes; and the subsequent fall of sugar prevented that repayment, which, with the ordinary confidence of West Indians, was anticipated in the course of a few seasons.

French colonies.

French colonies.—The foreign settlements of France have differed from those of Holland, in being more extended in the West than in the East. In the war of 1756, the military talents of Lord Clive, and the decided superiority of our navy, put an end to the question of ascendency between the French and English in the Eastern world. The same war stripped them of Martinique and Guadaloupe, although our solicitude to consolidate our North American possessions led to the restoration of these islands at the peace. But the pride of French colonies was St Domingo—a settlement never wrested from the mother country until the miserable disorders of the late revolution. At first the inhabitants of the French part of St Domingo, and of the adjacent islands, were composed of the free-booters, so well known under the name of *Flibustiers*, or Buccaneers. Two centuries ago, this lawless and intrepid race, an assemblage of pirates and desperadoes from all nations, were the terror of the Spanish Americans. Their situation, which was chiefly in the Bahamas and the quarters we have mentioned, afforded many facilities for adventurous enterprize, and deeds were performed which might supply many a subject for heroic poetry. Part of these atchievements have been rapidly traced by the animated pen of Raynal. In the course of time, the extension of regular government throughout St Domingo, and the rest of the West Indies, led to the incorporation of the descendants of these free booters into the mass of inoffensive citizens. The French colonies, being released, after the failure of the Mississippi scheme, from the restrictions of an exclusive company, advanced in population and prosperity with a success approximating to that of our colonies in North America. St Domingo became the greatest sugar and coffee colony in the West Indies, its population being computed, before the revolutionary disasters, at half a million of negroes, along with a correspondent proportion of whites.

The French colonists, like the English, went abroad only for a season, and steadily cherished the hope of returning with a competency to their native country. This feeling, however patriotic, is productive of an impatience in money making, which not only frequently defeats its object, but interferes very materially with the comfort of the colonist. Even in the long settled island of St Domingo, an island where the proprietors were much oftener resident on their plantations than in the English colonies, the want of domestic comfort was universal. "On n'y voit point d'homme," says Malouet, "assis sur son foyer parlant avec intérêt de sa ville, de sa paroisse, de la maison de ses péres. On n'y voit que des auberges et des voyageurs. Tout correspond à l'idée que j'exprime. Entrez dans leurs maisons, elles ne sont ni commodes, ni ornées; *ils n'en ont pas le tems*; *ce n'est pas la peine*; voila leur language. Est-il question d'un bâtiment, d'une machine, d'une transaction, d'un acte de partage, d'un réglement de compte; rien n'est fini, rien ne porte l'empreinte de la patience et de l'attention." Though disappointments in trade prevent the acquisition of fortunes in the limited period anticipated in their sanguine calculations, bad health, and impatience of an exile from home, are nevertheless productive of incessant removals. "Ici," adds Malouet, "la scène et les acteurs changent en moins de dix années: vous avez sans cesse des hommes différens; sans patrie, sans famille, sans projets, sans moyens déterminés; mais prêts à saisir tous les projets, tous les moyens." This colony, now sunk beyond redemption during the present generation at least, was, in natural fertility, greatly superior to the British settlements. On the sugar estates, the average annual produce of an acre is said to have been nearly one and a half hogshead, a quantity double, as appears from the preceding Table, the average of our colonies. St Domingo is said to abound in the fine brick mould, which in Jamaica is found only in particular districts. Accordingly in a period of ten years preceding the horrors of the revolution, the negro population, as well as the amount of produce, are believed to have nearly doubled. Martinique and Guadaloupe, though greatly behind St Domingo, have long been important colonies, their joint exports having amounted, many years ago, to a million sterling. The annual importation of slaves into the French colonies, before the revolution, was between 20 and 30,000.

The amount of produce exported from them, was	L. Sterling 8,000,000
The shipping employed	Tons 160,000
Number of seamen	above 30,000

The British West India trade was in value about two-thirds of the French; while the number of our seamen employed in it, in consequence of their superior dexterity, was less than half. In fact, the West India trade occupied half the mercantile navy of France, while, in our case, its proportion to the whole was not more than a ninth. The total of our mercantile tonnage, previous to the French revolution, was three times that of France; the number of our seamen was double. It deserves to be remarked, that, in the West India trade, the average size of British shipping is nearly 300 tons, while of French West Indiamen, so lately as the years 1791 and 1792, the average (Brougham, vol. i. p. 177.) was below 100 tons.]

Danish and Swedish colonies.

Danish and Swedish Colonies.—The northern powers were, at the time of the great discoveries of the sixteenth century, too insignificant to obtain any considerable share of these distant acquisitions. Their trade, as Sir William Temple says, was "war," and war conducted on land and in their own neighbourhood. About two centuries ago, Denmark acquired some small settlements on the coast of Coromandel; and agreeably to the current practice, put them under the management of an exclusive company. This company shared the ordinary fate of these associations, and became insolvent. It was succeeded, in the course of years, by a second, a third, and even by a fourth company, all of whom arrived at the same end; the demise of the last, however, being procrastinated, as in the case of our own East India Company, by the union of territorial sovereignty with the possession of the exclusive trade. At last, in 1777, the crown purchased the rights of the company, and opened, under certain limitations, the India trade to individuals at large. In 1792, these limitations were farther relaxed, and all persons, whether Danes or foreigners, were permitted to trade with India, on condition of bringing their cargoes to Copenhagen. The long war which followed, and involved all the south of Europe, threw a great deal of India trade into the hands of the Danes; and their flag was used as a convenient medium by private traders in our own country. It has been for a century past, the policy both of Denmark and Sweden to avoid maritime war, and to profit by the hostilities of other countries. Nothing but the pressure of necessity would have made the Danes depart from this course in 1807.

The West India colonies of Denmark consist of Santa Cruz, and of two insignificant islands. This trade was formerly vested in the hands of a company who failed; and for a long time this trade likewise has been open to all inhabitants of Denmark, with hardly any other restriction than that of bringing their produce to the capital, or to a port which is privileged to erect a sugar refinery.

Sweden possesses no colony except the small island of St Bartholomew, which was obtained thirty years ago from France. The trade with this little spot is also under specific limitations, Stockholm and Gottenburg being the two privileged harbours, and an association bearing the name of a West India Company possessing the direction of the intercourse. The returns, however, do not probably amount to £50,000 a-year. The Swedes have likewise an East India Company, whose dealings are very limited, and who are in the peculiar, but probably not unfortunate situation of possessing no Indian territory.

General Observations.

Motives for emigration.

Motives for Emigration.—It is common to make a distinction between ancient and modern colonies, by ascribing the origin of the former to the want of subsistence, and that of the latter to commercial projects. The distinction, however, holds less generally than many are inclined to suppose. The want, or rather the imagined want, of subsistence, had a powerful operation in sending abroad many of the English emigrants to North America. Mr Brougham has caught this idea, and is at great pains (vol. i. p. 94.) to shew, that, in the progress of society, certain classes may be exposed to a very sensible diminution of their accustomed enjoyments, and consequently acquire a disposition to emigrate. While we have great pleasure in bearing testimony to the ability of his illustrations in this and several other topics, in his *Colonial Policy*, we cannot help thinking, from the length of his observations, that he has sought too far for the motives which lead to the exchange of an old for a newly settled country. In our opinion, the comparison which an ardent mind is prepared to make between the unbounded prospect offered by the one, and the well-ascertained toil and trouble attendant on a continued residence in the other, is amply sufficient to account for such emigrations. As to the facility of obtaining subsistence, we are inclined to think that most long settled countries are on a par, for the plain reason, that an increase of population is invariably found to attend an increase of provisions. Ireland contributes annually a considerable number of colonists to the American states; and the emigrants, be it remarked, are chiefly from the Protestant part of the population. Now, on the score of subsistence, the Irish Protestants are less uncomfortably situated than their Catholic neighbours who do not emigrate; a fact which shews that the influence of necessity, in this case, is a relative, not an absolute feeling. Moreover, a passage to America costs at present, and, we believe, always did cost, a sum which, small as it may be, would afford to the emigrant the means of subsisting at home for a season. Our opinion, therefore, is, that the want, not of a mere subsistence, but of a comfortable livelihood, has been the chief motive for emigration in modern as well as in ancient times; and that this want was not, in general, the result of any sudden or particular change of circumstances, so much as of the predilection with which a man, aware of the necessity of prolonged labour at home, is apt to contemplate his prospects in a new country. Adverting to the case of Scotland, we admit the Highland emigrations to have been, in general, the result of a direct cause,—the loss of employment to the inhabitants, by the extensive introduction of sheep-farming. On the other hand, the annual drain of our young countrymen from the Lowlands to the West Indies, affords a striking example of the relative nature of the consideration mentioned above. They go abroad in quest, not of a mere support, but, as they imagine, of a more comfortable one than they can find at home. A farther argument in favour of our view of the cause of emigration, is to be found in the agricultural situation of Great Britain. Until the middle of last century, or rather until the year 1770, we were in the habit of making annual exportations of corn; a sufficient reason for not going out of the country in quest of a bare subsistence. Ireland at the present day is a corn-exporting country; and were the husbandry of Lothian, Berwickshire, or Northumberland generally introduced into the more favourable soil and climate of the west and south of England, a material alteration would ensue. Great Britain would cease to be dependant on foreign countries for corn, and might be enabled to maintain even an additional population from her own resources.

Causes of colonial prosperity.

Causes of Colonial Prosperity.—Various reasons concur to accelerate the progress of a colony in the career of wealth and consequence. The country chosen for a colony has generally the advantage of a good soil and climate. The colonists, emigrating from a civilized quarter, bring along with them the habits both of industry and of subordination. They bring also a small capital, not perhaps in the shape of money, but in that of tools, or other productive stock; and they are little actuated by that ostentation and disposition to expence, which, in our part of the world, interferes so materially with the augmentation of property. Utility is the great object in a new settlement, and the habits of consumption do not greatly exceed the limits of necessity. Their towns are few, and, for many years, of small size, so that the majority lead a country life: a situation of all others the most conducive to habits of economy. The local government is generally guided by a correspondent train of feeling. It meddles little with foreign affairs, seeks no quarrels, and confines its expenditure within very narrow limits; the consequence of which is, that the taxes are very light, and the citizen is left in possession of almost all the fruits of his labour. The augmentation of property would be still quicker, were capital abundant among them; but men of capital do not emigrate, and in new colonies, consequently, the rate of interest is high. Of all the advantages, however, of a new colony, the most important is the abundance of subsistence. The woods which afforded a scanty support to a few families of savage hunters, are converted, by the axe and the plough of the farmer, into luxuriant corn fields. In such a country, a numerous family of young persons, instead of being a burden on their parents, become a source of additional income. Uncleared land is to be bought for a trifle, so that the means of extending cultivation are within the reach of all persons above the lowest rank. One of the chief consequences of this state of things, is discovered in a high rate of wages. Where people multiply so fast, the great want is the want of labourers to provide for their accommodation. The domestic and the mechanic are much more independent of their masters, than in a country where a recourse to agricultural habits is impracticable. These circumstances, if not calculated to make them respectful in behaviour to their superiors, have, politically speaking, the good effect of affording strong inducements to industry. The journeyman in a town, like the labourer in the country, is enabled soon to engage in business on his own account, and to pay his assistants the same liberal rate of wages which he formerly received. In such a community, the chief expence of a family consists in the price of the manufactured articles, which it is necessary to import from the mother country, or from some long settled quarter; and which, in compliance with the vulgar notion of loss by consumption, are generally saddled with heavy duties. Another serious article of expence, consists in servants' wages, which, like all other wages, are, in such a situation, very high.

In the existence of these circumstances, varied, as they necessarily are, by difference of situation, we shall find an explanation of the rapid growth of almost all colonies. Were our materials sufficient, we might be enabled to trace their operation in the ancient settlements of Asia Minor, Italy, and Sicily, as clearly as in the well authenticated history of New England, or of the territory adjacent to the Cape of Good Hope. It was in consequence of such causes, that Tyre rose superior to Sidon, and Carthage, in her turn, to Tyre. The population of the thirteen United States of America bids fair, before the expiration of the present century, to surpass that of the greatest nations in Europe. In point of literature and works of taste, our American brethren, it must be confessed, are hitherto much behind the brilliant example of the Grecian colonists. The spirit of trade seems, in the United States, almost wholly to absorb that time and attention which, in other countries, is shared with more refined pursuits.

Insalubrity of tropical settlements.

Insalubrity of Tropical Settlements.—Powerful as are the above-mentioned causes of colonial prosperity, their operation will be found more applicable to the state than to the individual. The facility afforded by them, is not that of making a fortune, but of rearing a family. In speaking accordingly of colonies, such as the West Indies, where, from unhealthiness of climate, and deficiency of the comforts of life, the settlers do not contemplate a permanent abode, we must make very considerable deductions from the operation of the favourable circumstances of colonies. The advantage of bringing up a family at a cheap rate, becomes, in a manner, lost in such a situation; the settlers either not marrying at all, or finding it expedient to have their children educated in Europe. Here lies the great difference between our sugar colonies, and the more congenial climate of the northern part of America. Were our young countrymen, in particular those north of the Tweed, apprized of the real nature of a West India life, they would discover much less eagerness to try their chance in so hazardous a career. They take up a vague notion of the wealth of the West Indies, from the example, perhaps, of a few individuals in their neighbourhood, who, having realised a competency, get credit, throughout an uninformed circle, for being men of fortune. The young adventurer is too little acquainted with the world, to make the requisite deduction from the sums, of which the vanity of these envied persons, or of their friends, represents them to be possessed. He is likewise too little aware of the danger of the climate, to calculate how many have fallen victims to it, without in any degree attaining the object of their emigration. The fact is, that during the last fourteen years, the acquisition of property in the West Indies has been much more difficult than at home. If, for the sake of taking the matter on its fair side, we consider the bad times at an end, and regard the colonies as restored to their ordinary course, we shall still find very serious deductions from the supposed rapidity of money-making. The expence of living—the high interest on borrowed funds—the endless procrastination of payments—the accumulation of law expences—the frequent occurrence of losses by the death of debtors, who, like most men in that country, have no property but their personal exertion, are all obstacles to the success of even the prudent and industrious settler. When to this unpleasant list we add the decay of constitution by the climate, there seems no doubt of the balance being in favour of a life passed, however laboriously, in the mother country. Admitting the acquisition of property in the West Indies in a given number of years to be quicker, it is not greater (nor by any means equal) when a suitable deduction is made for the effect of climate in abridging the duration of life. A large proportion of the settlers are cut off in the outset of their career, and the survivors are, in general, found by middle age to have advanced much nearer to a state of infirmity, than if they had remained inhabitants of their native clime. Sir William Young, among other useful documents on the West Indies, has given the public tables of the mortality among the British troops in the West Indies. He divides the year, very properly, into two parts; the dry and healthy period from December to June, and the rainy season from July to November. In the latter interval, the mortality (see his *West India Common Place Book*, p. 220.) is more than double the former; and, putting the whole year together, the proportion of deaths among our troops, even without taking the field, or undergoing particular fatigue, is eleven in the hundred. This computation proceeds on the supposition of newcomers arriving out at the most favourable time, viz. the beginning of the dry season. It is greatly below the average loss of the British troops in these colonies, on a computation of seven years, of which Sir William presents the following melancholy picture.

Table shewing the mortality of British troops in the West Indies (exclusive of those who fell in action) during seven years, from 1796 *to* 1802 *inclusive, compiled from regimental returns by John Sayer, Esq. army commissary.*

	European soldiers.			Negro soldiers.			Officers
	Largest force.	Died.	Per cent.	Force	Died	Per cent.	Died.
1796, April	19676	6484	40¼	2495	75	3	226
1797, April	13627	3766	32¾	3080	118	4	99
1798, April	9192	1602	17½	3055	252	8	38
1799, Feb.	7654	876	11½	3354	258	7¾	24
1800, Feb.	8840	1221	15⅔	4320	286	6⅔	58
1801, Feb.	11745	2340	22¾	4604	276	6	104
1802, Feb.	10198	990	11	3840	199	5	41
Original army	19676	17173					590

On considering the inexperience of young emigrants to the West Indies, we apprehend, that the proportion of casualties among them does not fall greatly short of the conclusion suggested by this distressing catalogue; and that, on a comprehensive calculation, the average chance of life among these imprudent adventurers does not exceed *six or seven years*.

In comparing the East and West Indies on the score of health, we find a considerable difference in the fate of Europeans in these respective quarters. Though the degree of heat is, generally speaking, greater, and of course more unfavourable to a northern constitution in India, the cases of mortality are of less frequent occurrence. The explanation of this difference, is to be sought in the superior accommodation, and means of prolonging life in a cultivated and well inhabited country. Accordingly, while in the West Indies, the lot of our countrymen is either a sudden decease, or the preservation of considerable vigour, the European residents in India exhibit many examples of life protracted in spite of an enfeebled constitution. The habit of exaggerating the amount of property acquired at a distance, prevails, above all countries, in regard to India. A French writer, M. de Montgaillard, has lately gone the length of declaring, that "Bengal, and not England, is the main spring of British wealth; Calcutta, not London, the emporium of our commerce." Those among our countrymen who have tried India, and have had practical experience of the absurdity of these exaggerations, are accustomed to consider the last age as much more favourable to fortune making in India than the present one. We, on the other hand, are inclined to suspect that there has been all along a general misapprehension in regard to the magnitude of India fortunes; but, without dwelling on this matter, we shall briefly advert to two points, both of a nature to modify considerably the magnificent conceptions of the treasures of the East. These are, the long period almost uniformly required by our countrymen in that quarter to realize a competency; and the necessity apparently incumbent on the majority of them to remain unmarried until they are past middle age—a time when they must forego the hope of living to see their posterity settled in the world. The truth is, that in nine cases out of ten, the money made in India is made by saving; it is the result of the combined operation of time, and of a calculating economy. Of late years, however, it has experienced a considerable check, its main source, the high interest of money, having undergone a material reduction.

We have dwelt the longer on the mistaken ideas entertained in regard to our East and West India settlements, because an accurate knowledge of these vaunted regions would tend greatly to reconcile our countrymen to habits of steady industry at home. Those, however, who are bent, at all hazards, on trying their fortune abroad, would do well to bear in mind the difference between a southern climate and that of Canada, Nova Scotia, or the northern part of the United States, where, in favourable situations, and with prudent management, the chance of health is nearly as good as at home.

Nature of colonial trade.

Nature of Colonial Trade.—The colonial policy of England, and of other countries, has proceeded on the assumption that the trade with our foreign settlements was essentially different from the home trade. Our legislature has cared very little whether the colonists had a profit or not, provided we obtained a profit ourselves; and wherever the respective interests appeared to clash, there was very little discussion about which should give way. Now the fact is, that the colonial trade is in principle the same as a branch of home trade, with the single exception of distance of situation. In dealing with the continent of Europe, one capital is British, the other foreign; the profit is divided between us and the subjects of another government. But in the case of our colonies, both ends are British, and the total profit centers among ourselves. The difference between the home and colonial trade consists not, as many imagine, in a distinction of interests, but in a comparative slowness of returns. This is a matter of great consequence, both in a general and individual light, and as it is very little understood by persons out of trade, it may be useful to explain it at some length. In newly settled countries there is an extent of employment, almost indefinite, for capital and the rate of interest is consequently high. The inhabitants, having very few funds of their own, carry on their concerns in a great measure on a capital borrowed from their connections in Europe. They are proverbially slow in their repayments; and it has likewise been the policy of most colonial legislatures, with a view to forward improvement, to throw impediments in the way of the recal of money advanced on loan to settlers. The law is favourable to the creditor, as far as regards the provision of security, and the payment of the full rate of interest, but it gives him little aid in regard to the resumption of the principal. The consideration for all this delay and uncertainty in colonial business, consists in allowing a higher rate of mercantile commission than in the home trade. Notwithstanding this counterpoise, the unfortunate course of things, during the last fourteen years, has created a general aversion from colonial business. Instead, however, of pronouncing it a line absolutely disadvantageous, and home trade absolutely the reverse, it is more correct to regard the former fitted for a merchant of large, and the latter for one of small capital. Failures in the colonial, as in other branches of commerce, originate almost always from people going beyond their depth. Whoever advances money in the colonial trade, must be prepared to consider that portion of his capital as removed for a length of time from his controul, a course which no prudent man will allow himself to pursue in regard to the whole of his property. When a correspondent is found to disappoint expectation, it would be idle, in the present state of our colonial law, to seek a recovery in a court of justice. The proper plan is to apply to another mercantile house, more affluent or more adventurous, and to make it their interest, by a sacrifice, either of a part of the money, or, more properly, of time in regard to repayment, to take over the concern, with its profits and its responsibility, giving security for the ultimate reimbursement of the original lender. Merchants trading to colonies so recently settled as Trinidad, Tobago, Demarara, or Surinam, find infinite difficulty in avoiding a progressive and serious augmentation of advance. In quarters which approach to a more complete state of cultivation, as Barbadoes, Antigua, St Kitt's, the wants of the borrower being more easily ascertained, there is less hazard of additional demands. Jamaica being in some parts highly cultivated, while in others it has extensive tracks of land in a state of nature, may be said to partake of either situations; though the vexations characteristic of a new colony must be allowed to predominate. From all these considerations it follows, that our colonial trade, without being necessarily disadvantageous, or, as a long course of distress has made it be termed by many, ruinous, is a branch of business fit only for particular persons; we mean, persons both of large property and of long experience in the line. It centers, in a great measure, in London, and is much more suitable to the habits and circumstances of merchants in the metropolis, than to those of the outports. The latter, limited as they are in point of capital, would consult their interest much more by confining themselves to the capacity of agents for the former, than by attempting a direct connection with the planters.

Negro labour.

Negro Labour.—That impatience to change the scene of residence, with which M. Malouet so strongly charges the French planters, happens, we must confess, to be fully as applicable to our own. The continuance of the practice of performing labour on sugar estates by means of slaves, may be traced, though somewhat indirectly indeed, to the influence of this feeling. The eagerness of planters to buy negroes at a price much beyond what it would have cost to rear them, was an evident consequence of the disposition described by Malouet. A similar cause seems hitherto to have prevented any deliberate examination of the expediency of providing for the gradual emancipation of the negroes. It has been much disputed among political economists, whether there is in reality any saving by employing slaves. M. Say, one of the most successful commentators on the work of Dr Smith, ventures, in this respect, to dissent from our countrymen, and enters (*Traité d'Economie Politique*, vol. i. p. 215.) into a long calculation of the expence of slave labour. The result is an estimate of L. 20 or or L. 25 sterling as the annual cost of a negro's support, a sum which he contends (p. 218—225) is greatly below the amount of their annual earnings. On the other hand, Dr Smith, Sir James Stewart, and M. Turgot, maintain, that slave labour is more expensive than free labour, because a man in that situation, having no interest in his work or in his savings, toils as little and consumes as much as he finds possible, while the same reason operates to prevent him from acquiring that practical dexterity which seldom fails to reward the persevering attention of the free labourer. At the time when M. Say wrote, (1803), the abolition of the slave trade had not taken place, and the imagination of that valuable writer was impressed with the most gloomy conception of the condition of the West India negroes. The circumstances attending their passage from Africa, appeared to him full of horror. "*C'est* (p. 225.) *le chemin de l'averne qui conduit aux enfers.*" Apprehensive that many ages must elapse before the planters can be prevailed on to change their plan of labour, he proceeds to enquire whether it is not practicable to obtain sugar from other quarters. He cites the well-known M. Poivre as an authority for the low price of sugar in Cochinchina, and maintains, that Europe might derive sufficient supplies from that quarter without participating in the crime of oppressing the degraded natives of Africa. When we consider the much greater length of an India voyage, and the disappointment experienced in the case of the Bengal sugar, so much vaunted twenty years ago, we must dissent from M. Say, and continue to expect our chief supplies from the western hemisphere. Nor are we without hopes of obtaining them without much violation of the duties of humanity. Already very considerable improvements have taken place in the care of negro women and their offspring in their years of infancy. To increase the number of negroes on our plantations, by mild and attentive treatment, is now perfectly understood to be better policy than to overwork them for the sake of making a few additional hogsheads of sugar. Without laying stress, therefore, on the influence of humanity, we may safely trust to the policy of the planters for a disposition to treat their slaves in the way that benevolence would dictate; although, it must be confessed, that they and their white servants have much to learn before they can be accounted capable of doing justice to the health of their humble dependants.

Disadvantages of colonies to the mother country.

Disadvantages of Colonies to the Mother Country.—In bringing our remarks to a conclusion, we shall venture to say a few words on a topic on which mercantile prejudice runs as strongly against us as the feeling of the planters against the economists in the case of slave labour. By way of illustrating our views, we shall have recourse to the sanction of past events. When our North American colonies succeeded, in 1783, in finally obtaining their independence, there was a general belief that the brightest season of our commerce was past. No person ventured to think that our colonial trade would be as profitable as before; and to have said that it was about to become more profitable, would have been accounted a singular example of delusion. The fact, however, was, that the colonies continued to make their purchases of manufactured goods from us in the same way as before, and that their new situation gave them additional means for the augmentation of these purchases. Before the æra of their independence, an export to them of British goods to the amount of three millions, was accounted a most favourable year of trade; but of late, eleven and twelve millions were, in general, exported; and when harmony is restored, we may anticipate a steady export of fifteen millions or more. In analyzing the causes of this auspicious augmentation, we find them of two kinds—increase of capital, and increase of people. Both would have been in a course of advancement had the colonies remained subject to us and our regulations, but the ratio of progress has been much more rapid in their independent state. The way to quicken the increase of capital is to leave its possessor at liberty to buy and sell wherever he thinks proper. In the case of the Americans, the principal change that took place was the purchase in Holland and other countries of a proportion of commodities, chiefly raw produce, which we formerly obliged them to take from us at a higher price. If we reckon the amount of these purchases at L. 1,000,000 a year, and the annual saving to the Americans at L. 200,000, we shall soon find the benefit of the saving in an increased demand for our manufactures. The L. 200,000 saved, formed an annual addition to the American capital, and increased, in a correspondent proportion, their general power of purchase. While one fourth part of it was employed in extending their continental trade, it is no exaggeration to compute that the remaining three-fourths were remitted to this country. From official returns some years ago, it appeared that the United States purchased only to the value of three millions a year from the continent, while from us they took the triple, or rather the quadruple sum mentioned above. (Baring *on the Orders in Council.*) It is evident, therefore, that of every additional guinea made by America, the half, or more properly two-thirds, were vested in British purchases. Need we add more to prove that it is our interest to let them increase their capital in their own way? If we forego a small profit on articles of continental merchandize, we have soon an opportunity of reaping this profit threefold in the extended purchase of our own goods consequent on this saving to the Americans. It is clearly better for us to sell them twelve millions in value of British manufactures, than six millions of the latter, and two millions of continental goods. Now this is no unfair statement of the difference produced by the independent situation of the United States. Had they remained till now part of our empire, they would have been involved in the war of 1793; and even in peace, they would have been without all the saving and consequent augmentation of capital which has ensued from their purchasing continental produce at the first hand.

The course of our reasoning will be rendered clearer by attending to the material point, that in the case of foreign merchandize re-sold to the Americans, the loss to them was much greater than the profit to us. Of the sum of L. 200,000 already mentioned as the computed amount of enhancement, the chief part went in freight, insurance, warehouse rent, and shipping charges, on all of which the clear profit is much smaller than persons out of trade are apt to imagine. The advantage to our merchants on such transactions will not be underrated by estimating the gain of all the parties employed at one-fifth of the L. 200,000. Next as to revenue: Those who calculate on public emolument from the carrying trade, appear to forget that our duties are almost always drawn back on re-exportation. Is it not better, therefore, that a people eager to make an annual extension of the purchase of our manufactures, should increase their disposable capital by L. 200,000 a year, than that we, for the sake of L. 40,000, should cause them a loss to that amount? It may, however, be urged, that the additional employment in the importation and re-shipment of the continental merchandize was productive of considerable advantage to this country. Now, in reply, we have to ask, whether in time of peace any considerable number of our countrymen ever are at a loss for employment? Even in war, the want of work has been very little felt until the Orders in Council, an act of our own, caused a kind of revolution throughout the commercial world. The truth is, that the wants of mankind are such as to supply, necessarily and permanently, an effectual demand for the labour of the industrious; so that we may allow the consumers of merchandize to provide themselves, on all occasions, in the shortest and cheapest way, without disquieting ourselves with an apprehended deficiency of employment. If we apply this course of reasoning, and the practical lesson given us by the example of America, we shall soon see that most governments have overrated the advantage of retaining settlements in the tributary shape of colonies. The value of colonial trade, when free and unrestricted, is, like the value of other branches of trade, of the highest consequence; but the amount of this value becomes materially lessened by the imposition of restraints. While, on the one hand, by favouring certain colonial articles to the exclusion of those of foreign countries, we commit the error so strongly deprecated by Dr Smith, of driving into the colonial trade an undue proportion of home capital; on the other hand, by compulsory limitations in regard to the sale of colonial produce, we cramp most seriously the growth of colonial capital. As matters stand, such sales can take place only through our medium; and had Mr Brougham composed his book with a knowledge of the eventful history of the last ten years, he would not have considered the monopoly in so harmless a light. If farther arguments are wanted to produce the conviction, that our colonies would be more profitable to us in a free than in a restricted shape, we need merely refer our readers to the instructive tract written on this subject by Mr Bentham, at the outset of the French revolution. Nor will it be unprofitable to make a practical contrast between the annual burden attendant on the defence and government of the West Indies, Canada, or Nova Scotia, and our complete exemption from expence in the case of the United States, from whom our mercantile gains are so much greater. See Humboldt's *Travels in Mexico*, Brougham's *Colonial Policy*, Smith's *Wealth of Nations*, Talleyrand on *Colonies*, Say's *Economie Politique*, Robertson's *History of America*, Bryan Edwards' *History of the West Indies*, Sir William Young's *West India Common-Place Book*, and Mann's *New South Wales*. (x)

COLOURS, in optics. See ACHROMATIC TELESCOPES, DISPERSION, and OPTICS.

COLOURS, in painting. See PAINTING.

COLOURS, in dyeing. See DYEING.

COLOUR, (*difference of, in the human species.*) Of all the external varieties in the human species, none are so remarkable as that diversity of colour which distinguishes the inhabitants of different regions of the globe. We see it in all its gradations, from the purest white, to the deepest ebony; and the question is, to ascertain the cause of these variations. Two hypotheses have been maintained on this subject; the one is, that all the varieties of colour may be accounted for from the effects of climate; the other is, that there have been, from the beginning, different species of the human race, possessing different colours, as their peculiar characteristics.

The first opinion is the most ancient, and we think it has been demonstrated to be the most philosophical. The ancients, who were scarcely acquainted with any black nation, except the Nubians, regarded them as the terminating shade of the tawny colour, heightened into blackness, by perpetual exposure to the rays of the sun. As far as their knowledge then went, every thing tended to confirm this opinion. They observed the shade of colour gradually to deepen as they approached the equator; whilst those nations which were farthest removed from the torrid zone, were uniformly found to have the fairest complexions: they could not therefore desire a more complete induction of facts to authorise their conclusion, that the different shades of colour were to be ascribed to the effects of climate.

Modern discoveries have greatly enlarged our knowledge, and furnished us with many facts totally unknown to the ancients. There are now found many exceptions to the rule which they adopted, and nations of very different complexions, are found under the same parallel of latitude. This discovery first gave rise to the hypothesis, that different regions of the globe have been peopled with different races of men. But if we take the thermometer for our guide, and estimate by the degree of heat, rather than the degree of latitude, we shall have a rule which approaches nearer to the truth, though subject to modifications which we shall afterwards specify.

It is impossible to estimate the degree of heat in any country, merely by measuring its distance from the equator: its climate is affected by its elevation above the sea, by the height of its mountains, by the extent of continent, or by the nature of its surface. All these circumstances operate with peculiar force on the continent of America, which is found to differ as much from the old world in its surface, and in the temperature of its climate, as its natives differ in appearance from other inhabitants of the globe. There are no blacks found in America, though the torrid zone stretches across its continent. But this is exactly what we might expect, on the supposition that the colour is affected principally by heat. The immense extent of ocean by which its shores are bounded, its lofty mountains, running almost continuously from one extremity of the continent to the other, with their tops covered with perpetual snow, cool the scorching breezes of the torrid zone, and convert it into a temperate clime. Were we then to find negroes in the torrid zone in America, as we find them in Africa, it would be the surest proof that they were a different race from the rest of mankind, as it would be evident that their colour could not be ascribed to the effects of heat. The plain of Mexico, according to Humboldt, is about eight thousand feet above the level of the sea, and this circumstance, though it lies within the torrid zone, must necessarily ensure a temperate climate; the inhabitants, of course, are found to be only of a tawny complexion. Similar causes operate throughout the whole extent of America, producing an uniformity of climate unknown in the ancient world, and consequently a much greater uniformity in the appearance of its inhabitants.

To this reasoning, however, it has been objected, that the difference of colour cannot be ascribed to heat, since tribes have been found within the torrid zone, in Africa, separated from each other only by a river, yet differing widely in appearance and complexion. Thus it is said, that on one side of the river Senegal, the inhabitants are perfectly black, on the other only tawny. If this be the fact, and we are not concerned to dispute it, we must seek for some modification of the principle which we have laid down, viz. that the difference of colour is to be ascribed to the different degrees of heat; and it is easy to account for this apparent anomaly without relinquishing the principle which we have assumed. It is evident, that the form and colour of the human body are much affected by the degree of refinement to which a nation has attained, by the food on which it subsists, or by the occupations in which it is most usually engaged. We observe a wide difference of appearance, in the different ranks of European society, varying, in general, according to the station, or employment of different individuals. May we not expect to see the same difference among rude tribes, placed in the same circumstances as to temperature, but differing widely in their general habits and employments? If cleanliness should ever become an object with any tribe in the torrid zone, or if they should ever alter their ideas so completely, as to esteem *blanching* of the skin a beauty, in that case there can be little doubt that even the Ethiopian might in some degree change the ebon gloss of his complexion. But though we cannot expect this change of complexion to be effected by any voluntary effort on the part of people, who esteem blackness beautiful, and who unquestionably find it convenient; yet it may be produced by circumstances over which they have no controul, or by habits which they may be unwilling to relinquish. There can be no doubt that their colour must be considerably affected by the nature and quality of the food on which they subsist. We see a visible difference in the flesh of the same animals, according to the nature of their food, and we must naturally suppose the same effects to be produced on the human body, by the same circumstances. A tribe which lives chiefly on fruit, or vegetable productions, may be expected, *cæteris paribus*, to differ in complexion from those who live on fish, or animal food; and they who live on clean and wholesome nourishment, from those who feed on coarse and filthy fare.

From these causes it is easy to see, how conterminous tribes may differ considerably in their external appearance, since every thing that influences their habits and manner of living must, in some measure, affect their appearance and complexion.

But besides these permanent causes of distinction, there is another which must not be lost sight of; that is, the recent settlement of various tribes within the limits of the torrid zone. It is a fact, ascertained beyond the possibility of a doubt, that a tribe which has emigrated from a temperate to a hot climate, will be many ages in acquiring that shade of colour which distinguishes the indigenous inhabitants. Were we, therefore, to find two tribes possessing the same habits, and enjoying the same temperature as to climate, yet differing considerably as to complexion, it would be absurd to resort to the unphilosophical expedient of supposing a difference of species, when the circumstance might be easily explained from the recency or antiquity of their emigration. The world is not yet old enough to ascertain the fact, how long it will take to pass from white to the deepest black. As far as our experience extends, however, we see every generation descended from white parents in the torrid zone, acquiring a deeper tinge, and gradually approaching that complexion which distinguishes the perfect negro. We are told that the Portuguese settled at Mitomba, a river in Sierra Leone, have, by their marriages with the natives, and by the operation of the climate, degenerated into perfect negroes, with woolly hair, thick lips, &c. and retaining scarcely a trace of their original, except a smattering of the Portuguese language.

We have as satisfactory evidence, that a similar change is produced when negroes are transplanted to a temperate climate. Every succeeding generation is fairer than that which preceded it, though we are not as yet able to ascertain what length of time is necessary to wash out the constitutional stain from their skin. We have, however, the most undoubted authority for the fact. It is expressly affirmed by the Abbé Raynal, with respect to the descendants of negro parents in North America; and more particularly by Dr Smith, of New Jersey, who has examined this subject with great accuracy of observation, and who informs us, that the negroes, in the United States, though intermarrying with each other, are gradually losing the curled hair and black complexion of their African progenitors.

Thus then, great heat, and the exposure of many successive generations to its influence, are necessary to the production of that colour which distinguishes the negro; and the same length of time, accompanied with an inversion of circumstances, would be requisite to bring him back to his original hue. The Jews afford the most remarkable illustration of these observations: though scattered over the face of the earth, they have in general remained a distinct and separate race, with not a drop of blood in their veins but what has flowed in a direct course from Abraham: yet how various is their complexion? They are found fair in Britain, brown in Spain and Portugal, copper-coloured in Arabia and Egypt, and almost wholly black in Abyssinia, and at Cochin in India.

With regard to the Jews at Cochin, Dr Buchanan, in his *Christian Researches*, furnishes some particulars which show, in a very remarkable degree, the effect both of climate and of long residence. There are two descriptions of Jews at Cochin, the one he denominates black, and the other white Jews, and concludes, evidently without any theory in his head respecting the sameness, or diversity of the human species, that the former owe their dark complexion to their long residence in the country, whilst the latter have not resided long enough to complete the dye. His words are, "It is only necessary to look at the countenance of the black Jews, to be satisfied, that their ancestors must have arrived in India, many ages before the white Jews. Their Hindoo complexion, and their very imperfect resemblance to the European Jews, indicate that they have been detached from the parent stock in India, many ages before the Jews in the West." There is therefore every probability that these white Jews will one day become as black as their sable brethren. This conjecture is in a great measure confirmed by the remark of Dr Smith, that the people of the United States, though sprung originally from many different nations of Europe, have now all an uniform cast of features and complexion.

We trust it will sufficiently appear from the facts which have been stated, that colour is a superinduced habit, and that no particular shade of it can be regarded as an inseparable adjunct of human nature; and when we observe that a white nation is never found under a fervid sun, nor a black one under a moderate temperature, it is impossible not to ascribe the difference of colour in the human species to the variations of climate, with the other accessaries which have been specied. There is no sudden transition of colour, no definable line of demarcation; but we observe the shades gradually deepening or mellowing, according as the countries are exposed to a violent, or a moderate heat. This completely destroys the argument, that a particular race different from the rest of mankind, was necessary to people the torrid zone; on the same principle it might be alleged that as many separate creations were necessary, as there are degrees of latitude from the equator to the poles.

There are indeed certain plants and certain animals, confined, by the constitution of their nature, to particular districts of the globe, and which cannot thrive beyond these limits. But nothing is more obvious than that the same species of men can exist, thrive, and multiply in every part of the known world, after their constitution has undergone that kind of transformation which is necessary to adapt them to their new situation. In fact, the very circumstance of man's being born without any natural covering or defence against the injuries of different climates, shows that he is intended as an inhabitant of all: and the Author of his nature has given him the power of adaptation, both in the resources of his own ingenuity, and in those insensible changes which are effected in conformity with the laws of nature, over which man has little or no controul. In the latter case, he enjoys no higher privilege than the bounty of heaven has conferred on various species of animals which are found indifferently in various climates; but have different colours and appearances according to the situations in which they are placed. Thus, hares, squirrels, and weasels, are white in northern latitudes, but brown or gray in milder climates. They are even found to vary their colours in the same country, according to the different degrees of heat. In Sweden, for instance, the hares are gray in summer, but perfectly white in winter. *Lepus apud nos*, says Linnæus, *æstate cinereus, hieme semper albus.* And in still higher latitudes, when the cold returns, both birds and animals assume the livery of winter.

Why then should we not expect to find the same variations in the skin of the human species? It is no anomalous appearance; it is the general law of nature, and we should have greater reason to be surprised did we find man an exception. It is impossible to assign any other cause for these varieties of colour than this, that such is the will of the Author of nature. The seat of colour in the human species has indeed been ascertained. It has been found that the skin consists of three *laminæ* or layers, the outer or scarf skin, the inner or true skin, and a substance interposed between them, which, from its nature and appearance, has been called *rete mucosum*. This is found to be the seat of colour, the outer and inner portions of the skin being found the same both in black and white people. This substance is found to be black in the Negro; reddish in the Mulatto; brown in the Gypsey; white, with a slight shade of red, in Europeans; and of a dead white in the Albino; whilst in all these instances, the *epidermis* or scarf skin is perfectly white. But this is only an additional fact; it is no explanation of the phenomenon.

If we can trust the accuracy of Barrere's observations, as stated in his *Dissert. sur la couleur des Negres*, we may perhaps go a little farther, and ascertain the *immediate* cause of the black colour. He supposes it to be owing to the colour of the bile, which, from several dissections of Negroes which he made in Cayenne, he affirms to be as black as ink; and as an effusion of the bile in white people tinges the skin of a yellow hue, the same effusion in Negroes will make the skin perfectly black. This is, no doubt, a curious fact; but why should the bile be constantly effused so as to tinge the skin in black people, whilst this happens only occasionally in the case of others? And were we to suppose, with Buffon, that both the bile and blood of Negroes are much blacker than in the case of other persons, and that the blackness of the skin is owing to these circumstances, this would only be removing the difficulty a step farther back; and it would still remain to be inquired to what this blackness of the blood and bile is owing. In the present state of our knowledge, we must be content to ascribe it, generally, to the heat of the sun, without being able to explain how the effect is produced.

But whatever may be the immediate or remote causes of the Negro complexion, we can discover, at least, a most beneficent *final* cause of such an appointment. It was long ago discovered by Dr Franklin, that black transmits heat more readily than any other colour. The subject has been investigated with much more minuteness by Mr Leslie and Count Rumford. The former discovered, by a set of most conclusive experiments, that hot water, in vessels of the same capacity, but of different colours, cooled fastest in those which were of a black or dark colour. And by taking a cubical vessel of tin, and coating one of the faces with lamp black, he found, by means of his very delicate differential thermometer, that much more heat was radiated or thrown off from the black side, than from the others which had been left clear, or which had been differently prepared. May we not consider, then, the black colour in the human species, which is only found in the most scorching climates, to be a wise expedient provided by the Author of our nature, for cooling the fever of the blood under the influence of a tropical sun?

We hope what has been said will be sufficient to account for the varieties of colour in the human species. But had we even been unable to trace so accurately the operation of heat on the human complexion, had we found black and white men, indifferently, under the various degrees of latitude, or of heat, we would see no more necessity for supposing a difference of species, than for applying the same expedient to solve the phenomenon of white and black sheep in the same flock, whose pedigree can be indisputably traced to the same ancestors. The varieties, in this case, are evidently accidental; though there is every probability that they might be perpetuated; and some have thought that the varieties in the human complexion are of the same kind. This might do well enough as an argument to make a stand upon, if others were wanting; but we think we have already stated others more philosophical, and of more decided efficacy in their operation.

It is certain, however, that there are some very remarkable *accidental* varieties in the human species. A very singular race of people is found on the Isthmus of Darien, whose colour is perfectly white, not, however, resembling the white skin of Europeans, but the dead white of the *Albino*. These people produce children of the same complexion and appearance with themselves, though there is every probability that they sprung originally from the copper coloured Indians of the Isthmus: because it is observed that this is sometimes the case still; and two copper-coloured parents sometimes produce an *Albino* child: nay, *Albinos* have often been born of perfect negroes. And it ought to be remarked, that *all the children of negroes are born white*, that the dark colour comes on in the course of a few months, and gradually deepens, in a course of years, into a glossy black. We have not, however, the same evidence of black children being ever produced from white parents, otherwise the hypothesis of an accidental variety giving rise to the negro race might be admitted; though we cannot see why this should not take place, more than the other variety. See Buffon's *Nat. Hist.* vol. iii. Smith's *Essay on the Variety of Complexion and Figure in the Human Species*. See Complexion for an account of the arguments for the other hypothesis. (*g*)

COLUBER. See Herpetology.

COLUMBA. See Ornithology.

COLUMBIA, a genus of plants of the class Polyandria, and order Monogynia. See Botany, p. 241.

COLUMBIUM. See Chemistry, vol. vi. p. 30, 96.

COLUMBO. See Ceylon, vol. v. p. 698.